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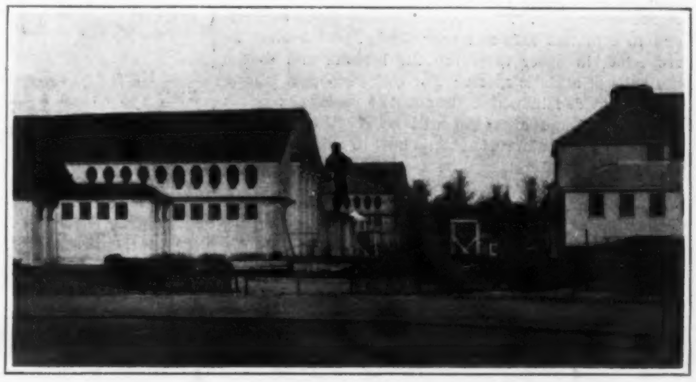
## The International Hygiene Exposition at Dresden

The International Hygiene Exposition which was opened in Dresden last month, after four years of diligent but unostentatious preparation, and which will continue open until November, is called an exposition in default of a better name. The real purpose of this great enterprise is the promotion of the health of humanity. A hygiene exposition was held in Berlin, as far back as 1883, when the science of hygiene was in its infancy, and small local exhibitions of similar character have since been held in various countries, but none of these compared in extent and importance with this year's international exposition at Dresden, which forms a comprehensive review of everything which the mind of man has devised for the preservation and promotion of human health since history began.

The immense mass of material which has been collected in accordance with this far-reaching plan, is divided into five departments, each of which constitutes an extensive exhibition in itself. These include a scientific, a historical and ethnographic, a popular and a sport and exercise department, with each of which are associated appropriate parts of the fifth department, devoted to industries and manufactures. This five-fold division is a happy idea, and it possesses the great merit of giving proper recognition to the needs, tastes, point of view and powers of comprehension of each individual visitor.

The advantage of separating the scientific from the popular department will be recognized after a moment's consideration. The exhibits of the scientific department chiefly interest the specialist, while those of the popular department appeal to the popular mind. It is desirable that the attention of the ordinary visitor shall not be burdened and distracted by things which do not interest him and which he does not understand, and it is equally desirable that physicians, students of

THE HALL OF CHEMISTRY AND SCIENTIFIC INSTRUMENTS



THE HALLS OF SPORT, FOOD AND CLOTHING

THE RUSSIAN BUILDING

THE JAPANESE BUILDING

THE AUSTRIAN BUILDING

A BRIDGE CONNECTING THE TWO EXPOSITION PARKS

THE INTERNATIONAL HYGIENE EXPOSITION AT DRESDEN

hygiene and public health officers shall be able to study the special exhibits which they alone can comprehend, without being annoyed by the intrusion of material which is perfectly familiar to them, and therefore superfluous.

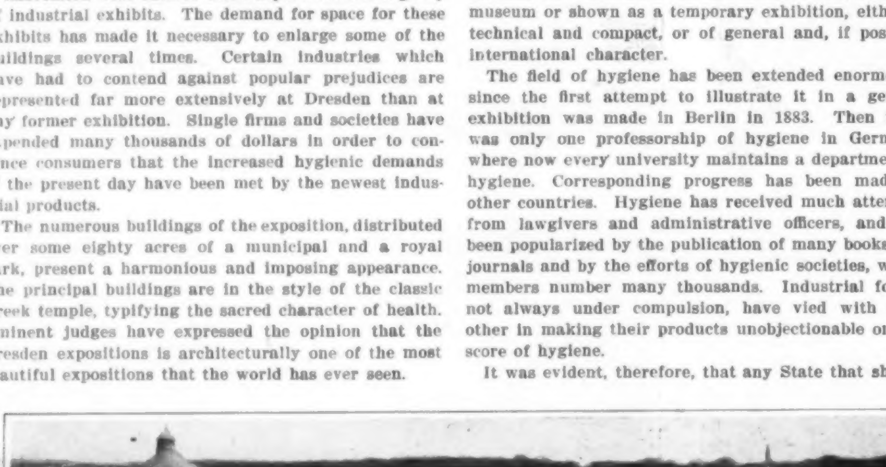
The historical department presents, for the first time, a complete and systematic history of hygiene. Here, to the amazement of the average visitor, is exhibited evidence of the attention which was devoted, thousands of years ago, to the health of the individual and the community. For example, it is shown, in a striking and original way, that the basic idea which underlay all the laws and admonitions of Moses was the restoration of the physical health of his degenerated people, as a necessary pre-requisite to their spiritual development. The religious precepts in which he embodied an advanced system of hygiene are the work of genius. It is probable that the Jewish race would have become extinct, if it had not been preserved by this well-conceived plan of social hygiene.

This is only one of the examples which prove the incorrectness of the popular idea that hygiene is a very modern science.

The hygienic idea, however, is steadily progressing as is proved, for example, by the increasing popularity of athletic sports, in which many brain workers find an indispensable source of physical recuperation. Hence sport will be represented at Dresden by a special group of exhibits and also by competitions for the championship of Europe in various events. Like other good things, sport may be and often is carried to excess, and has thus fallen into disrepute among large classes of the community. An endeavor will be made at Dresden to establish safe and sane limits, which must be respected, in order to secure the benefits and escape the evils of athletic sports. For this purpose a laboratory is provided in which the effect of various exercises upon the human organism will be studied in detail. No similar laboratory of sport is now in existence, even in America or England, the two countries in which athletic exercises are most honored.

Associated with each of these departments is a group of industrial exhibits. The demand for space for these exhibits has made it necessary to enlarge some of the buildings several times. Certain industries which have had to contend against popular prejudices are represented far more extensively at Dresden than at any former exhibition. Single firms and societies have expended many thousands of dollars in order to convince consumers that the increased hygienic demands of the present day have been met by the newest industrial products.

The numerous buildings of the exposition, distributed over some eighty acres of a municipal and a royal park, present a harmonious and imposing appearance. The principal buildings are in the style of the classic Greek temple, typifying the sacred character of health. Eminent judges have expressed the opinion that the Dresden expositions is architecturally one of the most beautiful expositions that the world has ever seen.

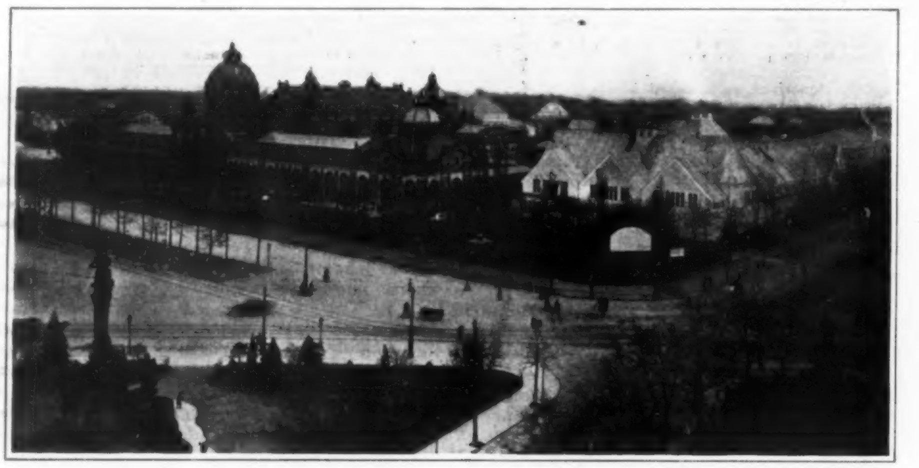


THE BRIDGE, HUNGARIAN BUILDING AND POPULAR BUILDING

THE INTERNATIONAL HYGIENE EXPOSITION AT DRESDEN

China and Japan, as well as America and all the nations of Europe, are represented at this great exposition of hygiene. With few exceptions, each country has a special building. Individual cities, with their smaller and consequently more intensively cultivated fields of public hygiene, are also represented in large numbers.

The two great objects which the exposition is designed to promote are: First, the improvement of the hygienic conditions of the mass of the people, which is the special function of municipal and national governments, and second, the instruction of the individual in the laws of health, as the influence of governments on the hygienic conditions of individual life is necessarily limited. The history of the International Hygienic Exposition may be said to have begun in 1903, in which year an Exhibition of German Cities was held in Dresden. Here, and subsequently in Munich, Frankfort and Kiel, was shown a special group of exhibits, relating to epidemic diseases and their prevention, which proved so interesting to specialists and the general public alike that many persons expressed a wish that it might be enlarged to embrace the whole field of hygiene and continued in the form of a permanent museum or shown as a temporary exhibition, either of technical and compact, or of general and, if possible, international character.



THE MAIN EXPOSITION BUILDING AND THE HALL OF CHEMISTRY AND SCIENTIFIC INSTRUMENTS

The field of hygiene has been extended enormously since the first attempt to illustrate it in a general exhibition was made in Berlin in 1883. Then there was only one professorship of hygiene in Germany, where now every university maintains a department of hygiene. Corresponding progress has been made in other countries. Hygiene has received much attention from lawgivers and administrative officers, and has been popularized by the publication of many books and journals and by the efforts of hygienic societies, whose members number many thousands. Industrial forms, not always under compulsion, have vied with each other in making their products unobjectionable on the score of hygiene.

It was evident, therefore, that any State that should undertake to hold an international hygiene exhibition which should adequately represent present conditions must be prepared to perform thoroughly and conscientiously a great and difficult work, at considerable expense. In 1905 a committee met in Dresden to consider the possibility of holding such an exhibition in Germany. The obvious suggestion that the task should be assumed by the Imperial or by the Prussian Government was abandoned because the sentiment of Berlin was averse to the holding of great exhibitions. This narrowed the choice to the two great States of Bavaria and Saxony, that is, to their capital cities, Munich and Dresden. A favorable reply having been obtained from the Saxon Government, the most eminent hygienists of Germany, together with numerous representatives of the Imperial and State Governments, assembled in Dresden in 1906 to consider the project more fully. It was unanimously decided to hold the exposition, if possible, in Dresden and to make its scope international and exceedingly broad. A board of directors was selected and a general plan was formed which required a subvention of two million marks, a guarantee fund of one million marks, the occupation of a large area of a city park and the adjoining royal park, and the gratuitous erection of the main exhibition building by the city of Dresden. After considerable difficulty and delay, these modest demands were granted by the authorities, and the guarantee fund was raised by popular subscription.

All doubts respecting the reception which the project would meet in industrial circles were quickly dispelled. Prominent manufacturers pronounced the exposition peculiarly opportune and necessary, because the industries which are most intimately connected with hygiene had not had opportunities, at other great expositions, to show adequately and convincingly the progress they had made in satisfying the requirements of modern hygiene. Applications for space came in in embarrassing profusion, as has already been mentioned.

In determining the general idea and plan of the International Hygiene Exposition little aid could be obtained from the study of previous expositions, the general character of which has scarcely varied in a hundred years. According to the orthodox program, the special purpose and scope of the exhibition is first determined, the public officials, societies, firms and individuals interested are invited to take part, the exhibits contributed are grouped according to subject, and places of refreshment and amusement are added. In short, the purposes and methods of the modern great expositions, like those of the old-time annual fairs, have been almost exclusively commercial.

Although exhibitors and visitors have derived much benefit from such expositions complaints have come from both sides. Many exhibitors have complained that the benefits derived did not compensate them for their outlay, while visitors have objected that the accumulation of vast numbers of similar objects produced weariness, made it difficult to find the exhibits of real importance and detracted from the educational value of the exposition. The question of reform in expositions has lately been much discussed and various methods of raising expositions to a higher plane have been proposed. All of these schemes, however, retain the fundamental defect of previous expositions, dependence upon the will and caprice of exhibitors. The exhibits are determined largely by chance. Many interests decline to exhibit at all, others are represented by a few forms of little prominence, while still others demand an inordinate amount of space. Hence some groups are very defective, while others are overfilled.

The Dresden exposition, on the contrary, has been designed to present a clear, intelligible and complete picture of the present state of hygienic science and practice, so arranged that the ordinary visitor can obtain much information in a short time and that the specialist can quickly find the objects that interest him. This involves the division of the exhibits into sharply defined groups, shown in separate buildings. In ordinary expositions little attention is given to the visitors' capacity for understanding and appreciating the exhibits. The average visitor, for example, stares at a machine which is a master piece of ingenuity, is

impressed by its size, complexity, bright polish and swift and silent movement, and goes away without the slightest idea of its real nature and value. A little elementary information would make a visit to the machinery hall far more interesting and profitable. At Dresden each limited group of objects is accompanied by instruction in the theory and history of that group.

The whole field of hygiene is covered, in the first place, by 12 principal groups (divided into 44 smaller groups) of exhibits of purely scientific interest, each of which has its own building or sharply defined part of a building. With each of these groups is associated, in the same building, if possible, the corresponding group of industrial exhibits.

Separate from all of these is the historical and ethnographic section, which serves as an introduction to the whole subject of hygiene, and illustrates the hygiene usages of civilized and uncivilized races of all periods and countries. Another building is devoted to the popular section, which is designed to impart elementary notions of human anatomy, physiology and hygiene, to show the purpose and operation of sanitary regulations and to overcome popular prejudice against disinfection, quarantine, vaccination and other necessary hygienic precautions.

Finally there is a section of exercise and sport, containing athletic and gymnastic apparatus of every sort, together with a scientific demonstration of the effects of various exercises on the body.

The buildings of the exposition are constructed and assigned in accordance with this general plan. Separate buildings are provided for the sections "House and Home," "Food," "Clothing and Care of the Body," "Traffic," "Nursing and Life Saving," "Army and Navy," "Hygiene of Childhood and Youth," and "Baths and Water Cures." The eastern part of the main building is assigned to the historical and ethnographic section, and the western part to infectious disease and allied subjects with which no industrial exhibits are associated. A special building is provided for the sub-section of chemistry and scientific instruments. The section "Exercise and Sport" includes a large stadium, a scientific collection and a laboratory in which experimental researches on the effect of exercise will be made. Olympian games, football, tennis, wrestling, military drills, golf, fencing, pool, rifle shooting, horse racing, rowing and motor boat, automobile, airship and aeroplane contests are some of the sports that will be represented this summer at Dresden in connection with the International Hygiene Exposition.

The buildings of the exposition, designed by twenty-one leading architects of Dresden, are singularly dignified, appropriate and harmonious in style. Most of them are built of wood, but in order to minimize the danger of fire, they are completely covered and lined with plaster, stucco and fire-proofed fabrics. The architects unanimously agreed that the buildings should appear to be exactly what they are—temporary structures designed for a special purpose—and should not be fantastic monumental creations or pompous imitations, in wood and plaster, of historical stone palaces and temples.

The buildings are for the most part of one story, with side walls about 13 feet high. The wider halls have a higher central wave, with a clerestory for the illumination of the central part. Wide aisles, unobstructed vistas and abundant side light are found in all of the buildings. Simplicity and repose are the keynotes of the interior architecture; the idea is to present the exhibits clearly, and not to distract attention from them by impertinent ornamentation. Outwardly, the buildings are equally simple; they produce their pleasing and harmonious effect by the distribution of masses and by a sound and simple color scheme. The walls are covered chiefly with a coarse-grained stucco, painted white, which is diversified by a few colored lines and simple ornaments in relief. The roofs are brightly tinted with colors harmonizing with the green foliage of the fine old trees which surround them. The buildings cover about 18 of the 80 acres occupied by the exposition.

In connection with the exposition courses of lectures on various branches of hygiene will be given and a number of congresses will be held under the auspices of various scientific, technical, industrial, charitable and athletic associations.

# The Oldest Steam Threshing Engine

## Thirty Years of Service

### By H. A. Steven

Of all the threshing engines in use to-day in the world, the oldest is located within four miles northwest of Wheaton, Ill. For over thirty years this iron horse has done its work, outliving any traction engine, and is in as good condition as the day it came from the shops of the Aultman Company of Ohio. When it was purchased, the owner, Mr. A. G. Ransom, reasoned that a perpendicular engine would not wear out as soon as the horizontal type mostly in use, and the result seems to have confirmed his view. While the present boiler is the second one used, and a new set of flues has been put in, still the engine does not look the worse for wear.

The first test of this well-taken-care-of engine was in the threshing, on my father's farm, of oats which were dry and in the best condition. On the morning in question, in 1880, it started its work with a steady, even motion, and the grain was sent through a separator propelled by this old-timer, until evening, when it was found that the outfit had threshed out 2,750 bushels for the day's run. This is the world's record for oats threshed in one working day by a 10 horse-power mechanical contrivance. To be sure, there were no elevators or blowers or self-feeders on threshing machines at that period, but even with the aid of modern accessories operators in the business to-day would be glad to average 2,750 bushels of oats with their 25 horse-power engines and 60 inch separators.

There are three facts that must be admitted. First: The average threshing outfit has not lasted fifteen years. Second: The perpendicular engine will outlast any of the horizontal type. Third: In spite of theorists and book-learned engineers, the owner of this engine is the most practical engineer, a statement which I can substantiate by ample proofs.

He levels the separator and the engine with his eye, using the horizon, and not a level. It takes him five minutes to set the machine, and if a pulley is squeaking on the running separator he can tell which one of the former it is before it makes six revolutions. This almost instinctive knowledge may account in a great measure for the long life of the engine, and its extraordinary capacity for work as shown in what is probably another record, viz., the greatest amount of grain threshed by any one apparatus during a continuous period of thirty years.

The speed maintained during all these years for the cylinder on the threshing machine has been about 1,150 revolutions per minute, which partially explains why the wear and tear is so slight. At this speed the separator will stop before it is torn to pieces on wet grain, stones, pieces of iron, etc. The perpendicular pulsations or vibrations give a perfectly steady motion on the large belt. This, of course, tends to prevent the wearing out of the bearings and the working loose of the nuts.

In traveling up and down hill along highways, the water in the boiler has never left the part around the firebox, a condition which invites melting of the casing, and in some instances the explosion of the horizontal engine. When a horizontal boiler is moved forward down hill, the water rushes ahead and leaves the firebox bare, save for the dry steam, which latter will not prevent melting. This partly accounts for the long life of the two boilers used in this case.

THE OLDEST STEAM THRESHING ENGINE, STILL IN CONSTANT SERVICE

Carrying out the erroneous idea of housing engines when they are not in use causes many engineers to be particular in this direction but most negligent in others. This one was never put under shelter, but the essential parts were always coated with grease, and when the owner got through at the end of the season, he always lubricated the cylinder.

The modern method of feeding a thresher is most unscientific. Thoughtless youths and men, eager to get through, throw in six or seven bundles at a time, and expect the cylinder, fanning mill and elevators to do good work. This cannot be done, and as much time is lost as is gained by hurrying in this manner.

The last large belt from the engine to the separator is made of canvas, and has lasted twenty years, and in reference to this phase of the work, Mr. Ransom claims that rubber belts will last still longer when not exposed to the wet.

On warm days he uses from 1,000 to 1,200 pounds of soft coal, while in cold weather he burns from 1,200 to 1,400 pounds. The steam carried ranges from 80 to 100 pounds.

The team of horses used to guide the engine partly removes the danger of runaways along the public highways.

This engineer has a gasoline engine for use in churning, pumping, etc., which was purchased from the Fairbanks & Morse Company, twelve years ago, and it is just as good as new. How does he manage it? is the question. He claims that the average engineer does not think or does not care about machinery; that the average man running an engine is not a natural mechanic, nor does he school himself to take care of everything; and that the machinery will break and then the engineer will blame the manufacturer, when the absent-minded or negligent operator is the cause. We seldom find all of the following qualities in one person, that Mr. Ransom possesses; namely, a good carpenter, having built house, shop and barn for himself and for others; a successful well digger, having sunk over 150 wells; an excellent blacksmith and wagon maker; a good farmer, having averaged over 40 bushels of oats per acre and over 50 bushels of corn per acre for the last twenty years; and withal a broad-minded and well-read man on many subjects. His theory on the use of galvanized pipe in the ground is worth considering; the automatic float which he uses is highly interesting.

This engine, so ably run and so carefully preserved by its original and only handler, is indeed an object of interest as viewed in the illustration; and the record herewith of its performances and the lessons handed down by the practical owner, should appeal to all young men who may aspire to become engineers, and who may wish to take care of all kinds of machinery.

### The Gutta-percha Tree

On account of the extreme usefulness of gutta-percha in constructing submarine cables, every effort is being made to save the tree that yields the valuable gum from destruction. No satisfactory substitute for gutta-percha found in the forests of the Malay Peninsula and in Malacca has been discovered, but the natives, in order to get quick returns, are destroying the trees so rapidly that a gutta-percha famine is feared. To prevent this, the French, Dutch and British governments are striving not only to prevent the waste of the trees already existing, but to increase their number by transplantation and cultivation. Experiments with transplanted trees are being made in Reunion and Madagascar.

**To Produce Nitrogen** (According to Tichborne).—In a retort of sufficient capacity (about 1½ liters) place 10 parts (grammes) of sulphate of ammonia, 10 parts (grammes) nitrite of sodium, 40 parts (grammes) of glycerine and 60 parts (cubic centimeters) of water. Incline the neck of the retort rather sharply upward, so that the condensed water will drain back into the retort, and heat it. The generation of gas commences at about 90 deg. C. (194 deg. F.) and continues, at moderate heat, steadily, until the nitrite is completely reduced.

# An Air Propeller Testing Apparatus

## Professor Prandtl's System

THE following description and the accompanying illustrations deal with an air propeller testing apparatus described by Paul de Jeuhr in the *Zeitschrift für Flugtechnik und Motorluftschiffahrt.*

Most aeroplane propeller testing plants are wrongly conceived, because the conditions are not similar to those of an aeroplane in flight. Hence the results ob-

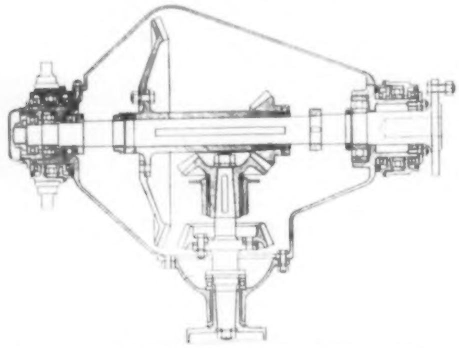


FIG. 1.—PROPELLER DRIVING GEAR, UPPER PORTION

tained cannot be directly applied to the flying machine without due allowance for many factors of error. Prof. Prandtl of the University of Goettingen was intrusted with the task of devising an entirely new type of propeller testing apparatus which would be free from any of the objections to which the stationary testing plant is open. This design was intended to furnish the following data:

1. The altitude of the apparatus was to be sufficiently large to measure propellers of great size and high speed.
2. The propellers were to be tested under conditions as similar as possible to those which obtained in a flying machine.
3. The apparatus was to be so constructed that it

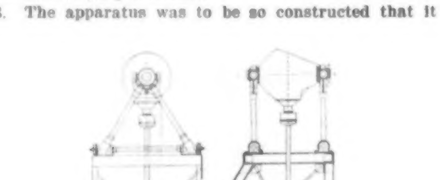


FIG. 2.—SIDE ELEVATION OF PROPELLER-TESTING CAR AND VIEW OF UPPER PORTION (END ELEVATION)

could easily be transformed into a stationary testing plant, if necessary.

The first condition was satisfied largely by correspondence with firms engaged in the construction of airships and flying machines. From this correspondence it followed that the largest possible propeller to be tested would have a diameter of about 5 meters, and that the propeller shaft in every direction would deliver about 60 horse-power when revolving at speeds of 200 to 1,200 revolutions per minute.

At first it was thought that a small boat such as the Zeppelin company originally used for the testing of its propellers might be available. It was finally decided, however, that it would be better for all purposes to have a machine which could be used on land. Naturally, some form of structure which traveled on rails suggested itself. This, in turn, gave rise to the first difficulty, the constantly changing direction of the wind and its influence upon the results obtained. This difficulty was overcome without a single accident by laying the track in the general direction of the wind, and by limiting tests to lateral winds which blew at an angle of not more than 20 degrees.

The front end of the car should offer as little resistance to the air as possible, and especially avoid the creation of eddies. To this end it is found best to employ a buoy-shaped casing for the driving gear, since a smooth passage of the air in the vicinity of the propeller is particularly desirable.

The wide variation in the dimensions of the screws

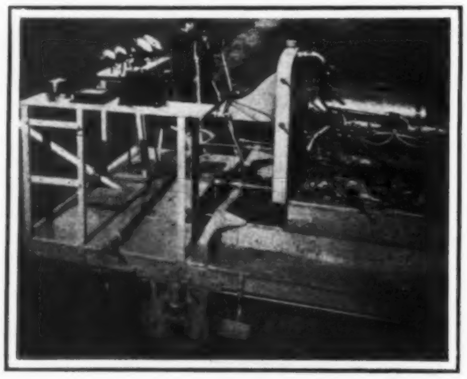


FIG. 3.—DRIVER'S SEAT AND INSTRUMENTS

To the right of the seat is a lever for throwing in the transmission; to the left is a lever controlling the motor; a pedal controls a friction clutch. In front of the driver's seat are the frequency meter, tachometer, and manometer. On the table in the background are the contact clock, special circuit breakers, and a chronograph.

tested caused another factor—the smooth running of the car—to assume importance, and this in its turn led to the endeavor to make the car as light as possible.

To be prepared for all contingencies, the rims of the wheels were made suitable for the rails either of standard gage railroads or tramways.

The wire-spoked wheels of 500 millimeters diameter, with reinforced tire, are fixed on the axles, and turn with them in triple ball bearings, which permit at the same time a certain play of the axles.

The casing of the ball bearings is suspended in a cast-steel hanger between two spiral springs, and this hanger also serves as a support for the angle lever of the unusually powerful internal expanding brake.

The brake, worked by a hand lever from the driver's seat, has two shoes inside the rim of each wheel. The driver's lever transmits the power through a shaft to a rod fixed beneath the two longitudinal girders, and this in turn acts on the two wheels of one side. Since the wheels of each axle are firmly attached to it, this gives a double security.

The frame of the car consists of four pressed-steel girders 100 × 40 × 4 millimeters in size, strengthened by two diagonal struts.

FIG. 4.—THE PROPELLER CASING

The octagonal sand-packed walls of the propeller space are visible, as well as the open, straw-packed doors.

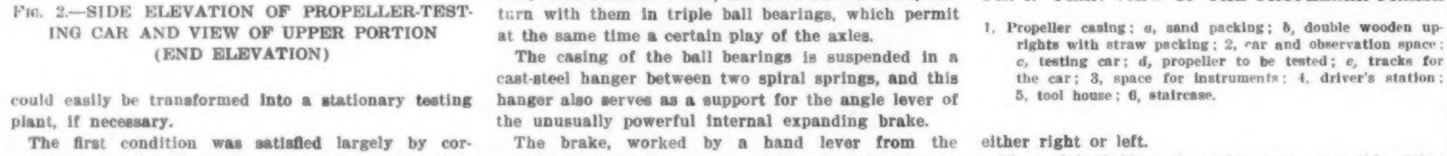
On this light frame the essential part of the driving machinery is mounted. This has proven advisable on account of the very considerable vibration. The parts consist of a 100 horse-power motor with normal speed of 1,800 revolutions per minute, propellers from the smallest up to 5 meters diameter and capable of making 200 to 1,200 revolutions per minute. The direction of rotation of the propellers may be


FIG. 8.—PLAN VIEW OF THE PROPELLER FRAME

1, Propeller casing; a, sand packing; b, double wooden uprights with straw packing; 2, car and observation space; c, testing car; d, propeller to be tested; e, tracks for the car; 3, space for instruments; 4, driver's station; 5, tool house; 6, staircase.

either right or left.

The original idea of a planetary reversible drive was dropped, because on account of the enormous power too much noise would have been made and the wear would have been too rapid. Furthermore



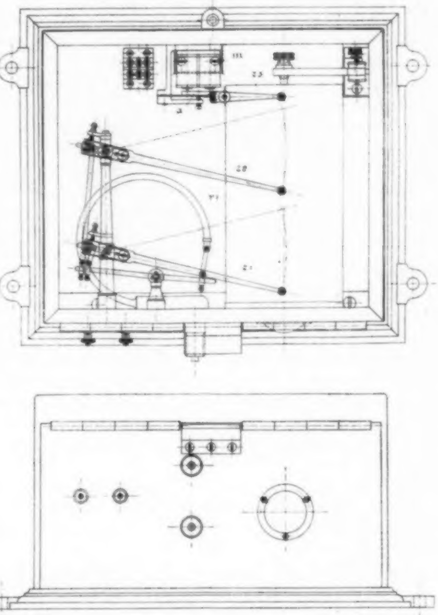

FIGS. 5, 6, AND 7.—DIAGRAM OF THE PROPELLER CAR AND CONNECTIONS WITH THE MEASURING INSTRUMENTS

Fig. 5 is a top plan view; Fig. 6, a rear end elevation; Fig. 7 a side elevation. In Fig. 7, a is the anemometer; b, the wind gage and scale; c, driver's seat; d, chronograph; e, second-contact clock; f, manometer for torque; g, manometer for propeller thrust; h, throttle; i, control cocks; k, revolution indicator of the motor shaft; k l, driving gear of the frequency meter; tachometer for the car axle; n, worm contact device for the motor shaft; o, storage battery for the electrical measuring instruments and for motor ignition; p, registering manometer; q, thrust-measuring cylinder; r, cylinder for measuring torque; $Z_1$ to $Z_5$, gears for driving the propeller shaft; $Z_6$, chain-driven reversing gear.

—— Electrical circuits of the measuring instruments. – – – Electrical circuits of the frequency meter. = = = Oil tube for registering propeller thrust. ≡≡≡ Oil tube for registering torque.

also the change in the number of revolutions beyond certain limits scarcely came with any one propeller and was not great enough to be important.

By the reversing of the propeller itself a more efficient drive was obtainable, so that this slight inconvenience was offset by decided advantages.



FIGS. 9 AND 10.—DOUBLE RECORDING MANOMETER

Side elevation and bottom plan view. $r^1$ ($r^2$ behind it), tubular springs; $z^1$, indicator or writing lever of the torque manometer; $z^2$, of the thrust indicator; $z^3$, writing lever for recording time actuated by the armature $a$ of the magnet $m$.

Even in the testing of many different propellers, as is customarily the case in prize competitions, a certain grouping is possible, so that a change of gear is necessary only after the testing of the group.

As the greatest propeller-thrust was taken as 300 kilogrammes, the greatest turning moment demanded was 300 kilogramme-meters on the propeller shaft, if the construction was carried out on the basis of this valuation.

The motor and propeller shafts, located at different levels, were connected through two sets of bevel gears and a vertical shaft.

The four changes of speed desired made necessary double sets of bevel gears, while still another pair of bevel gears on the engine shaft made possible the rotation of the vertical and hence of the propeller shaft in either direction, so that either right or left-hand propellers can be tested. In the upper casing a large and a small set of bevel gears were arranged, while a second set mounted on the engine shaft, on the opposite side of the vertical shaft, served to give the reverse.

The reversal above is effected by sliding bevel gears on the vertical shaft, upon which they are mounted on a feather. The four bevel gears on the horizontal engine shaft extension are secured to the shaft. The lowermost bevel of the vertical shaft and the hub of the upper wheel (which extends into a socket) are fixed upon the shaft in their positions.

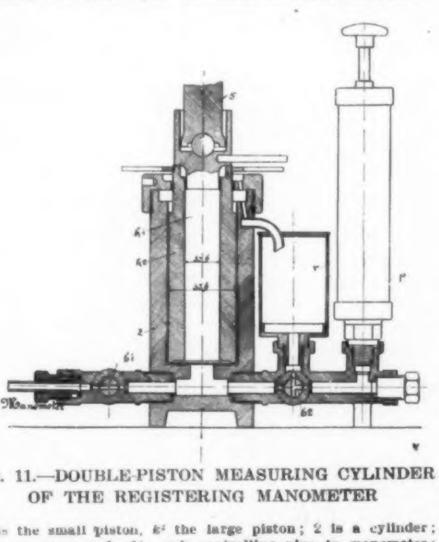


FIG. 11.—DOUBLE-PISTON MEASURING CYLINDER OF THE REGISTERING MANOMETER

$k^1$ is the small piston, $k^2$ the large piston; 2 is a cylinder; $s$, presser rod; $h^1$, cock controlling pipe to manometer; $h^2$, three-way cock leading to glycerine reservoir $r$ and the pump $p$.

When now the lower gear is in action the annular toothed ring forming the upper gear is drawn up out of the way and fastened to the top of the casing; if on the other hand the exterior gear is brought into action, then this ring is fastened to its (Nabe) by a jaw clutch.

In any case the horizontal shaft with its gears is displaced and united with the motor shaft by a suitable connection.

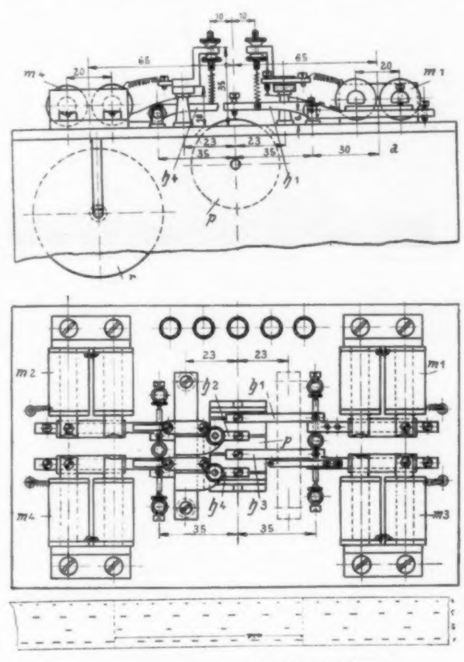
The cast aluminium casings are tightly closed, so that the gears can run immersed in the lubricant. The upper propeller shaft runs in ball bearings, the thrust of the bevel gears being taken up by ball thrust bearings (Kugel stützlager). All other bearings are of bronze with large surfaces.

The gears and their shafts are made of chrome nickel steel, which accounts for the small dimensions possible in spite of the severe strain caused by the sudden shocks.

The parts just described serve another purpose, i. e., they make possible the measurement of two things of importance, namely, the thrust and the turning moment necessary to drive them.

This is best explained by the diagram. On the trapezium-formed base to which a frame is firmly fastened, a parallelogram is movably carried by the propeller shaft. If the screw gives an outward thrust, the parallelogram has the tendency to tip toward the front, in which movement it is hindered by the angle lever with the presser rod.

The vertical pressure of this rod will therefore stand a definite relation to the propeller-thrust. The parallelogram, which is of triangular cross section for the prevention of a side movement, now carries on the propeller shaft the whole upper casing, the vertical shaft with its two universal joints permitting a marked oscillation of this casing.



FIGS 12 AND 13.—CHRONOGRAPH

Side elevation and top plan view. $m_1$, electromagnet for actuating the writing lever $h^1$ of the second-contact clock, $m^2$ with $h^2$ for the anemometer, $m^3$ with $h^3$ for the car velocity; $m^4$ with $h^4$ for the motor revolutions; $r$, paper drum; $p$, paper roll.

If now the propeller is driven, the reaction of its torque retards its driving bevel wheel and causes the opposite wheel of the vetical shaft to roll off upon it.

This motion, vertical to the plane of the propeller shaft, is transmitted through the bearing to the casing, which would now shift outwardly if it were not held by a suitable rod.

Through this simple arrangement the thrust and the torque can be estimated directly from the driving-shaft without the necessity of allowing for lateral effects, such as friction, etc. On this account also the suspension of the upper casing is so carefully carried out with many ball bearings, while in general the upper shaft merely has one ball bearing.

Even the bearings of the parallelogram, used only when it tips, are provided with balls on account of the weight they carry. The forward strut of the frame has an extension toward the front in order to distribute the propeller thrust well to the frame and thence to the under structure.

The end flange of the upper shaft is furnished with a boss; every propeller to be tested must have a flange. In order to test with safety heavy or large air propellers without straining the bearings, there is provided a removable brace made of steel tubes with binding in pieces, whose interiors move in two grooves in the direction of the length of the car in order to place a screw in each axle length.

The essential position of the propeller shaft in this frame, which can also be adjusted or displaced by different barrels of 25 to 70 diameter, consists of a ball bearing which by means of two lateral pins can swing in turn in ball bearings.

A movement forward relatively to the car, occasioned by the thrust of the screw, will therefore

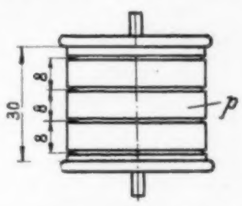



FIG. 14.—THE PAPER ROLL, P

not be hindered except by the presser rod provided for that purpose.

A rearward tipping of the parallelogram is avoided by a stop with an adjustable screw, while a movement out of the upper casing toward the side opposite to the presser rod is prevented by the construction of a steel tube provided with a rubber buffer.

The motor is provided with an ordinary leather friction clutch. Moreover, a claw clutch is built into the shaft in order to permit safe testing of the propeller with a running motor.

Because the tests are made on straight tracks, and because the screws drive the car in only one direction, a special method of driving the motor must be provided for the return journey. For this purpose a small bevel gear is placed on the intermediate shaft displaceably, which by means of a larger and a smaller chain gear drives the rear axle directly, after the whole propeller gear is thrown out by means of the chain clutch.

FIG. 16.

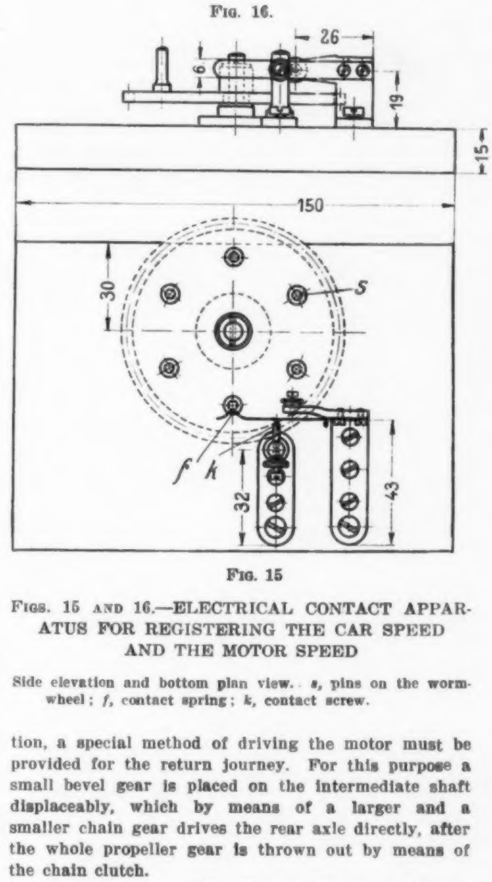
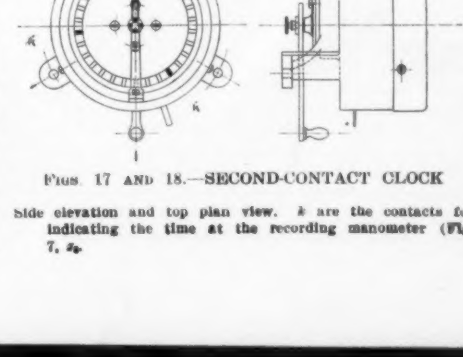



FIG. 15

FIGS. 15 AND 16.—ELECTRICAL CONTACT APPARATUS FOR REGISTERING THE CAR SPEED AND THE MOTOR SPEED

Side elevation and bottom plan view. $s$, pins on the worm-wheel; $f$, contact spring; $k$, contact screw.

Passing to the consideration of the measuring instruments, it is obvious that the chief desideratum is that they should be self-registering, since the attention of the driver is fully occupied by the observa-



FIGS 17 AND 18.—SECOND-CONTACT CLOCK

Side elevation and top plan view. $k$ are the contacts for indicating the time at the recording manometer (Fig. 7, $z_3$.

tion of the course and the attainment and maintenance of a certain uniformity of operation. Therefore electric indicators are preferred except for the thrust and the revolutions.

As we have seen, the propeller thrust and the revolutions of the same are indicated by the pressure on a vertical rod. For the automatic recording an hydraulic transmission was chosen, and this connected with a double registering manometer.

Under each recording lever is firmly fixed a measuring cylinder of chrome-nickel steel in which are fitted two smoothly polished pistons. These two pistons serve to give different ranges for small and large propellers. The manometer registers up to 25 kilogrammes per square centimeter, the small piston of 3 centimeters diameter suffices therefore for a rod pressure up to 150 kilogrammes, while the larger of 6 centimeters diameter can absorb as high as 600 kilogrammes.

When the small piston moves through the pumping in of a fluid (glycerine) the large piston must be forced up till it rests against the cover. Consequently, the small piston must vary from the large one by 1 to 2 centimeters.

On the other hand, if oil glycerine is allowed to flow out of the pump till the small piston rests upon the large, then the whole cross section is thrown into operation.

The connection with the presser rod is effected by a polished ball which lies between two ball pockets, which are on the other hand loosely centered by a cover.

Because of the different directions of revolution of the screw, the measuring cylinder for the torque must be reversible; tubing lies on either side (see diagram).

The pressure transmission leads the cylinders to two ordinary stop cocks, whose purpose is to check chance shocks in the tube transmission and keep them from affecting the manometers.

For this purpose the slits of the cock are soldered up; the valve itself, however, can be pressed against the cone or withdrawn, depending on the amount of the throttling.

From this point the piping leads to two flat-spring manometers with indicators which are gaged or standardized up to the double pressure of the registering manometer, 30 kilogrammes per square centimeter.

The control cocks lying behind these manometers are not opened until the indicator manometers show that the permissible pressure is not exceeded, as for instance might happen by accidentally moving the small piston, which might injure the delicate registering manometers.

These instruments are placed behind the car, since this is the place of least vibration, a position not completely satisfactory because here the recording is difficult.

The clockwork of the recording drum causes it to revolve once in 2 minutes; if we reckon 10 seconds for the duration of the trip, then there are a sufficient number of conditions united on one strip, if it is put on and taken off at the right time.

The second apparatus is the chronograph. Clockwork moves a strip of paper over a drum at a rate of about 13 meter-seconds beneath four writing levers operated by electromagnets. Needles serve as stylo, cutting a hole in the paper when the current is closed; when the current is closed for a longer time, a series of holes is made; since the levers are provided with current interrupters, as in the case of electric bells. Thus tearing of the paper is avoided. The indentations of the needles can be easily read on the reverse side of the paper.

This chronograph is operated in the following manner: On the intermediate shaft behind the motor a small worm is mounted meshing with a small worm wheel. In this worm wheel two diametrically opposed pencils are carried, which by means of a small spring close the current at every passing. The worm has but one entrance, the wheel has thirty teeth; therefore with two pencils there is a contact after every fifteen revolutions of the motor, this contact being indicated by the pencil as a point on the paper strip. In a similar manner the revolutions of the front axle are recorded, from which the speed of the car is found; but here up to six pencils may have to be screwed in, according to the expected speed, so that a sufficient number of effective contacts may be obtained.

Thirdly, the relative speed of the propeller to the wind is to be obtained. For this purpose the car is lengthened at the front end by a mast five meters long to whose point is attached a wind vane with a Robinson's anemometer above it.

The wind vane moves on two ball bearings, and serves the purpose of reading during the journey from the scale the deviation caused by the side wind.

The anemometer, whose buckets lie at a distance of almost 10 inches from the screw on the lengthened propeller axle, so that the suction may exert no influence on it (as experience has shown) is so arranged that it gives a contact after every twenty meters of its passage through the air, making a dot on the paper. (Fig. 14.)

Finally comes the important comparative instrument, whose records determine the measure of time, the second-contact-clock. (Figs. 17 and 18.) The revolving pointer makes and breaks the contacts; as these are rather long, a short row of dots is made instead of one dot.

But the importance of the clock depends on another device (see diagram). Every tenth contact is separated from the others, and leads the current, instead of to the chronograph, to an indicator of the registering manometer; therefore, there is a gap on the chronograph whenever a record is made on the manometer. Consequently, in synchronously arranged instruments, the speed belonging to a given thrust and moment of revolution is unfailingly indicated when the diagram is superposed that the second marks of the manometer bulletin fill out the gap of the chronograph diagram.

The meaning of the diagrams can be seen in Figs. 9 and 14, which do not, however, belong together, but merely serve as examples.

First the strips of the chronograph: In the upper row we see the regular time contacts of the clock, after every nine dashes a gap for the tenth second. Underneath the records of the anemometer, the cam axle and the motor shaft. For reckoning, a vertical line is drawn every 10 seconds, and merely the points lying between are counted. (In case of irregularities, a correspondingly greater time interval must be chosen.) Then we find in our example a speed of the propeller against the air of 3.33 points in 10 seconds; i. e., 0.333 in 1 second; therefore, 20.0.333 = 6.66 meter-seconds. To this is added the anemometer correction, which for this reading equals 1.004, so that the virtual speed reckoned at 6.69 meter-seconds, the speed of the car, is reckoned according to the following formula: The contact given on the car axle had three pencils with thirty teeth, and a worm with one entrance; therefore, each contact signifies ten revolutions of the wheel, which, on the other hand, with a 500 diameter = 15.28 meters, 6.25 points in 10 seconds, 0.625 in 1 second, corresponding, then, to a car speed of 9.55 meter-seconds. According to the foregoing, the diagram gives finally 11.15.6 = 990 revolutions per minute for the motor, from which can be estimated the revolutions of the propeller.

Next the manometer bulletin: The points *A* will therefore correspond constantly to a gap in the time marks on the chronograph, and it is necessary to mark exactly on both only the beginning of the experiment. The upper thrust curve is described when the large piston is working; therefore every kilogramme centimeter[2] of pressure corresponds to the cross section $\frac{6^2\pi}{4} = 28.3$ kilogrammes in the designated case; therefore = 9.1.28.3 = 257 kilogrammes.

But now, by means of the angle lever, the thrusting of the propeller is transmitted to the rod in the relation 2:1, therefore a virtual thrust is found of $\frac{257}{2} =$ 128.5 kilogrammes. The moment of revolution transmits itself to the presser rod by a lever arm of 0.5 meter, therefore corresponds to the pressure of (for example) 5.7 kilogramme-centimeters, in a cross section of the small piston of $\frac{3^2\pi}{4} = 7.07$ centimeters².

5.7.7.07.0.05 = 20.15 meter-kilogrammes.

There are also two instruments of importance for the guiding of the car—a tachometer for its speed, and a frequency meter for the number of revolutions of the motor. The first, a simple speed pendulum with a revolving indicator, is driven through belts by the forward axle, and gives the speed of the car in second-meters.

The frequency meter depends on the resonance principle, the exciter being driven through belts by the motor shaft, and connected with the revolution indicator.

These two devices and the indicating manometer are placed directly in front of the driver; the other instruments also are fastened to the table in front (see diagram).

Further, here are found at the left of the driver's seat the levers regulating the sparking and mixing for the motor; a foot lever operates the friction clutch, a large lever forward is for use in handling the brake, another to the right is used for the governing of the claw clutch, and, finally, somewhat to the rear, lies the lever for reversing.

The motor is turned forward, by which the inertia of the car is quickly overcome. Close by the motor is the seat for the observer, who always goes along on the trip.

The trial trips are conducted in the following manner: After the clutch of the gear intended for the propeller is thrown in, the meter transmissions and testing instruments are started, the car is firmly braked, the motor set going, the gear with the claw clutch thrown in, and the friction clutch on the motor slowly put in by means of the foot lever. After the propeller (with the car not moving) has been brought to the right number of revolutions, by the sparking and manipulating levers, the brake is removed and the car comes very quickly to the required speed. As soon as a certain uniformity is observed in the number of revolutions as well as in the indicating manometer, by means of drawing cords, the measuring instruments are put in operation simultaneously. Then the circuit is closed by a small governor in front of the driver's seat, while the driver tries to hold the speed constant by the regulation of the motor or use of the brake. As soon as a record is made, it is best seen by the striking of the time indicator on the registering manometer. The instruments are then stopped, and if the distance seems long enough, another speed is taken and a second observation is made.

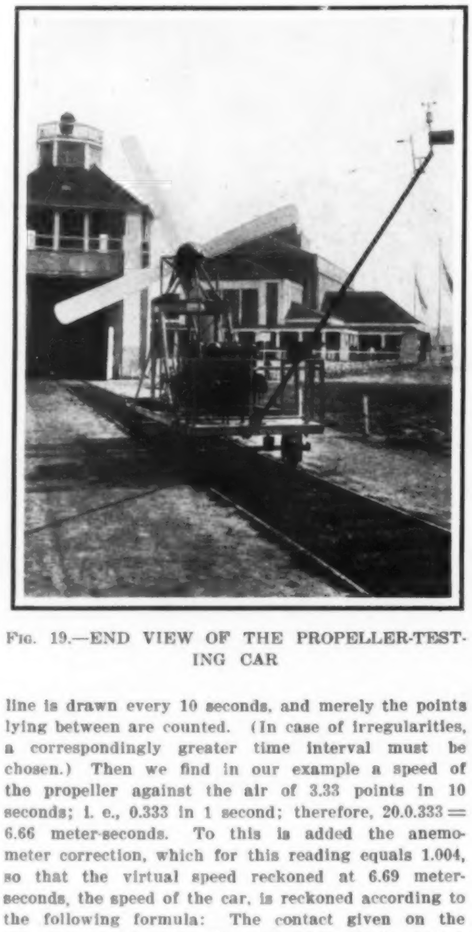


Fig. 19.—END VIEW OF THE PROPELLER-TESTING CAR

PRELIMINARY RESULTS OF EXPERIMENTS WITH THE APPARATUS FOR TESTING AERIAL PROPELLERS.

The tests of aerial propellers, made with the apparatus constructed for the first international aeronautic exhibition, are now completed. The results will shortly be published in detail. A brief summary of the results and the entries is given below.

The long postponement of the final tests was caused through delay in the construction of the apparatus, by an accident which necessitated extensive repairs, and, finally, by the long practice which was required in order to secure perfectly harmonious action of the numerous instruments and the assistants in their operation.

In January, 1910, in a large hall in Frankfort, tests were made of the propellers which had been entered in competition for the prizes offered by the Prussian war department, for propellers of German manufacture only.

This competition was subject to the following conditions:

1. Only propellers of uniform pitch were admitted.
2. The tests were made at a fixed point, the quantities measured being the tractive effort, the consumption of power, and the number of revolutions per minute.
3. The propellers were divided into two groups. The first group included airship propellers not exceeding 5 meters (16.4 feet) in diameter, which were required to develop a tractive effort of 300 kilogrammes (661 pounds) at a fixed point. The second group included propellers not exceeding 3 meters (9.8 feet) in diameter, which were required to develop a tractive effort of 150 kilogrammes (330.7 pounds).
4. All propellers were excluded in which the product of the pitch, multiplied by the number of revolutions per second required to develop the prescribed tractive effort, was less than 15 meters (49.2 feet) because the tractive effort of such propellers would vanish at a speed of 15 meters per second and the propellers would be unable to produce any useful tractive effort at the speeds required in practice.

5. A prize of 3,000 marks ($714), subject to devision, was offered in each group.

6. Each propeller must be accompanied by a statement of its pitch and the maximum number of revolutions for which it was designed.

7. The prizes were awarded for the smallest values of the product $N^3rG$, in which $N^3$ denotes the number of horse-power consumed, $r$ the greatest radius, and $G$ the total weight of the propeller.

The propellers originally entered for this competition numbered forty-eight, and eight others were subsequently sent as substitutes for propellers which had been broken, making the total number fifty-six. Two propellers of foreign make were excluded by the conditions of this national competition, three were rejected because their weight or construction made it impossible to test them with the apparatus provided, many failed to pass the test of strength applied by the centrifugal machine or broke during the final test before sufficient data had been obtained, and, finally, the requirement of uniform pitch restricted the competition to nine propellers, two of group I. and seven of group II. Details concerning the five propellers which made the best records are given in the following table, in which weights are expressed in kilograms and lengths in meters.

| Group | Required Tractive Effort | Radius $r$ | Horse-power $N$ | Weight $G$ | Product $N^3rG$ | Prize | Name of Exhibitor |
|---|---|---|---|---|---|---|---|
| II. | 150 | 1.05 | 39.3 | 6.55 | 10,620 | First | Reissner |
| II. | 150 | 1.13 | 38.5 | 12.5 | 20,900 | Second | Gross |
| II. | 150 | 1.50 | 34.2 | 30.0 | 105,300 | ...... | Ruthenberg |
| I. | 300 | 2.50 | 56.0 | 34.0 | 533,000 | First | Ruthenberg |
| I. | 300 | 2.50 | 54.6 | 99.9 | 1,475,000 | Second | Rettig |

Translator's Note.—The third, fourth, and fifth members in the column marked "Product" appear to be about twice as large as they should be in order to correspond with the numbers in the preceding columns.

drawn through the points thus established. The prizes were given for the maximum ordinates of the curve, or, in case these maxima were not attained in the experiments, for the highest measured points. The formulæ, experimental results and curves will be discussed in a future article.

Of the 56 propellers four were rejected because they could not be tested with the apparatus, three were withdrawn before the commencement of the experiments and seven were broken in testing. The prize winners and the several groups are given in the following table:

| Exhibitor. | Number of Blades. | Radius $r$. | Thrust $P$. | Torque $M$. | $v$ | $w$ | $\eta$ | $\zeta$ | $\vartheta$ | Prize. |
|---|---|---|---|---|---|---|---|---|---|---|
| *Group 1. Efficiency $\eta$.* | | | | | | | | | | |
| Reissner | 2 | 1.5 | 45.2 | 23.28 | 13.14 | 30.9 | 0.826 | . | .. | 1 |
| Rettig | 4 | 2.5 | 167.0 | 152.00 | 16.27 | 23.2 | 0.770 | .... | ... | 2 |
| *Group 2. Economy of Space $\zeta$.* | | | | | | | | | | |
| Reissner | 2 | 1.5 | 45.2 | 23.28 | 13.14 | 30.9 | .... | 0.936 | ... | 1 |
| Rettig | 4 | 2.5 | 191.8 | 84.8 | 9.7 | 15.3 | . | 0.908 | .. | 2 |
| *Group 3. Usefulness of High Speeds $\vartheta$.* | | | | | | | | | | |
| Zeise | 2 | 1.02 | 113.7 | 27.5 | 15.58 | 115.2 | .. . | ..... | 4.7 | 1 |
| Zeise | 2 | 1.05 | 77.6 | 21.9 | 8.98 | 72.5 | .. . | .. . | 4.4 | 2 |

## Rainfall and Parasites

That parasite diseases of stock are mainly due to wet and marshy pasture lands is very well brought out by M. G. Moussu, a member of the French Agricultural Society. He also shows how to remedy matters in such cases. For the last few years the amount of rainfall has greatly exceeded the normal, and if the year 1910 is to be counted as an exception in this regard, the preceding years 1908 and 1909 had their share in preparing the economic disasters

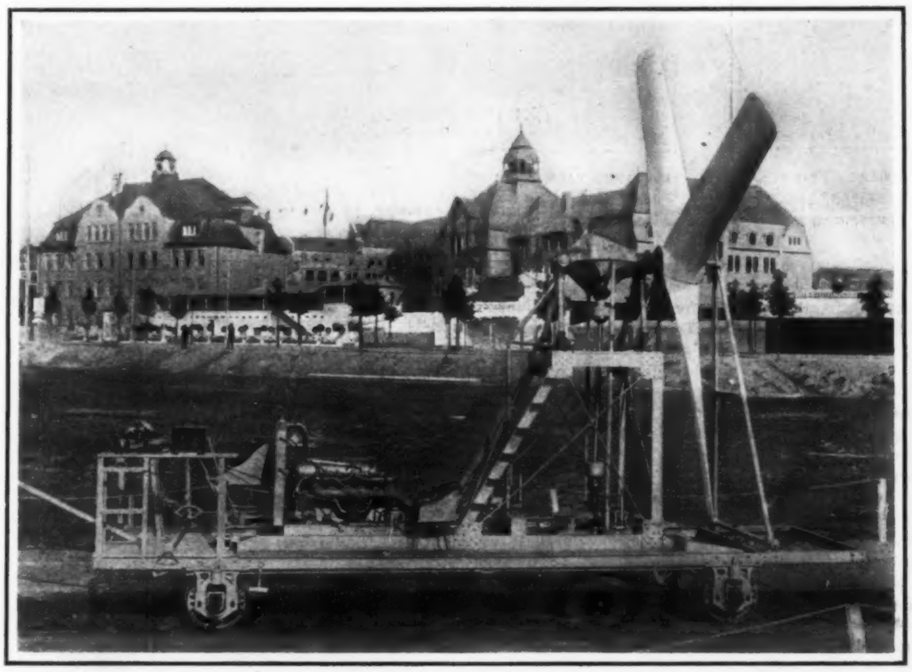


Fig. 20.—GENERAL VIEW OF THE PROPELLER-TESTING CAR

In the competition organized by the International Aeronautic Exhibition three qualities were recognized, and two prizes were offered for excellence in each. These qualities were:

1. Efficiency: $\eta = \dfrac{P \cdot v}{M \cdot w}$

2. Economy of space $\zeta = \eta \cdot \left( \frac{1}{2} + \sqrt{\frac{1}{4} + \frac{\varphi}{2}} \right)$

where: $\varphi = \dfrac{P \cdot g}{\gamma \cdot \pi \cdot r^2 \cdot v^2}$

3. Suitability for work at high speeds:

$$\vartheta = \frac{t^n}{M^2 \cdot \omega} \cdot \sqrt{\frac{P \cdot g}{\gamma}}$$

In these formulæ $P$ denotes the thrust of the propeller, $M$ the applied torque, $r$ the radius of the propeller, $v$ the velocity of the center of the propeller relatively to the velocity of the air current, $w$ the angular velocity of the propeller, $\gamma$ the weight of a unit volume of air, and $g$ the acceleration due to gravity. The values of $\pi$, $\eta$, and $\vartheta$ calculated from the experiments were plotted as ordinates to the values of $\lambda = \dfrac{v}{r w}$ as abscissas, and curves were

which we have felt recently. The persistent dampness favors the development and spreading of spore maladies which affect vegetables, and in stock raising the effect is none the less harmful. The continual rains, the freshets and inundations have greatly modified the aspect and the flora of meadow lands and transform the best pasturages into marshes. Here the animal parasites find a very good ground for developing outside the organism, and it is remarked that we find the great animal epidemics such as zootics of parasite origin to follow periods of inundation. The year 1910 is one of the worst in this respect, and sheep have especially suffered so that numerous flocks are disappearing for this reason. In the two preceding years other parasite maladies prevailed such as affected the stomach and intestines, but this year it is the parasite disease of the liver which causes the harm known as distomatose. The embryos of the parasites are absorbed by the sheep as they go among marshy pastures or along overflowing streams, and this is clear when we see that the malady only affects sheep which feed outside upon pasture land for most of the year. Wherever the soil is dry, on plateaus or arid summits, the malady is not observed, nor, on the other hand, when the animals are kept in the fold. But in especially damp years such as 1910 we find it appearing in places where it is usually absent, and the author explains this by the fact that the dampness favors an unusual development and spreading of parasite embryos. These the animals take into their system along with the food plants, and they pass into the stomach and liver, where they fix themselves and remain after the manner of parasites.

In France it is the sheep which are most affected, but we find similar maladies among young animals of the bovine race in other countries, and there are regions where even wild animals such as hares, or else rabbits and goats, die from this cause. This year the parasitic infection has been so strongly marked that the progress of the malady upon the animals is much more rapid than usual, so that they succumb within a short time instead of becoming anemic and pining away. Owing to the fact that such epidemics are seen only at comparatively rare intervals, there has not been paid the proper attention to finding a remedy for this state of affairs. But we already have the observations as to the manner in which the parasites act, so that it is not hard to draw some practical conclusions. Since it is the dampness which is at fault, the first measure is to drain the pasturages or take other measures so as to keep them as dry as possible. Such expense would soon be made up by suppressing the loss of animals. The second point is to improve the quality of the pasturage by processes such as sulphating and the use of chemical fertilizer during the spring, for the result appears not only in the modification of the flora, but also in the disappearing of a great proportion of parasites which are likely to cause maladies. But even this will not be effective in such unusual cases of dampness as we find in 1910, and here we must take special precautions.

In the regions which under ordinary circumstances are only slightly affected by the distomatose malady, but where the conditions change much for the worse by great dampness, the author recommends that the flocks should not be taken upon the pasture lands which were inundated, nor even upon lands which remain permanently in a wet state. Although this may be contrary to custom, it seems to be the only way to mend matters and preserve the flocks, so that there should be no hesitation about adopting this measure. With proper care and foresight the flocks can always be fed when in the stables, even with a low grade of fodder which is well prepared. It is to be noted that even fodder taken from the wet lands can be very well used provided it is well dried beforehand, as in this case it is no longer dangerous.

## Crude Oil Fuel in the French Navy

The French navy department is taking measures toward using petroleum residues more extensively in the future for heating marine boilers, owing to the advantages which are now so well recognized as coming from the oil fuel. This is one of the indications which show that the question of substituting oil for coal is occupying the attention of different countries. Oil is likely to be largely used in the future either for burning under boilers or for operating the new Diesel and other crude oil engines which are now being made in units of increasing size. As regards the use of oil residues in the French navy, the Minister of the Marine, Admiral Boué de Lapeyrère, is quite in favor of it, and is now engaged in promoting a number of plans which will lead to a more extensive use of this fuel. It is now recognized that it will be of great use in the navy owing to the greater speed and ease in taking fuel on board the vessels, and the greater radius of action which a boat will have owing to the greater amount of fuel represented as heat-giving power, which can be taken in the available given space.

All the new torpedo destroyers of the navy are installed for firing the boilers with "mazout" or petroleum residues of European origin. Up to the present the French seaports were not well equipped for handling and storing the oil, so that the cost per ton was very high and much more than in other leading countries. The admiral is now taking measures to organize more modern methods for handling the oil in the leading French ports, so that this country will be one of the foremost in this field. At the military ports such as Toulon, Brest and Cherbourg are now being installed great oil reservoirs in which the petroleum residues will henceforth be stored up, and besides this a very complete system is being organized, as the navy has purchased a steamer to be used specially for oil transport. It will ship on oil at the Roumanian port of Constanza in the Mediterranean region, which is one of the leading shipping centers for this product, and will then bring the mazout to the French ports and fill up the reservoirs directly, without the extra handling which heretofore brought up the cost to $31 per (long) ton, while it will be now reduced to $13 per ton. The new steamer has been named the "Rhone," and it gages 7,000 tons. It is also of interest to note that the 26,000-ton battleships "Courbet" and "Jean Bart" of the French fleet, as well as the new units which are to be constructed, will be fitted with the necessary appliances so that they can burn crude oil or residues at the same time as coal, making thus a combination system.

# The Cocoanut Palm

## Its Products and Their Uses

By Randolph I. Geare

SPEAKING on excellent authority it may be said that the almost universal demand at the present time for the cocoanut palm (*Cocos nucifera*) on account of the many and varied uses of its products is unprecedented. An American consul writes that "the world is being sought for additional supplies of cocoanuts."

One of the most valuable parts of the cocoanut is the dried kernel, called "copra," and in Germany the very recent discovery of practical methods of converting the crude copra oil into a palatable butter has given a wonderful impetus to the business in that country. Oil of the first pressing is used, which is bleached with boneblack or fuller's earth. The raw material contains sixty to seventy per cent of fat. It is white or very light yellow and has a sweet odor. This odor has to be eliminated, and it is done by expressing the oil with steam. The imports of copra into Germany last year, principally from the Dutch Indies, British India, Ceylon, Malacca, Samoa and the Philippines, amounted to more than 112,000 metric tons. Over 9,000 tons of the butter were imported, of which about 3,000 tons were afterward exported, the remainder being consumed locally.

Cocoanuts are imported into England chiefly in the form of copra, for the extraction of the oil. The only by-product resulting from crushing is used for cattle feeding, and is worth from $34 to $39 a ton. The best quality of copra comes from Malabar, and is worth about $136 a ton.

In Barcelona, Spain, many thousands of tons o copra are imported yearly, at an average of $117 a ton. The oil there is used wholly in making soap.

In the Philippine Islands the prospect for the cocoanut industry is brighter than ever before. Last year 1,658,724 piculs (a picul = 133 1/3 pounds) of copra were produced, making these islands the largest producer of this staple in the world, and excelling in product Java, the Straits Settlements, Ceylon, and the South Sea Islands. The price of cocoanuts in the Philippine Islands has risen greatly in recent years. The reasons for this are the extensive use of its products for commercial purposes, for making edible fats, such as "palmine," and the rise in price of articles now being supplanted by copra products. There is also a growing demand for cocoanut oil, for which millions of cocoanuts are used every day. The Consul at Hongkong writes: "The possibilities of the use of this nut fat should receive more attention from American manufacturers."

FRUIT CLUSTERS OF MATURE COCOANUT PALM, COSTA RICA

In India the exports of cocoanuts during 1909 and 1910, as reported from the Madras Presidency, amounted to more than 200,000. Of copra over 900,000 hundredweight, valued at more than $4,000,000, were exported, while the exportation of cocoanut oil amounted to nearly 5,500,000 gallons, worth about $2,500,000.

The Consul at Carlsbad, Austria, recently reported that owing to the fact that the oil from cocoanuts is now being converted into comestible fats, its market price has increased enormously, and the world is being sought for additional supplies of cocoanuts.

COCOANUT PALM AT CAJABON, ALTA VERAPAZ, GUATEMALA

COCOANUT PALM NEAR PALMIRA, CAUCA VALLEY, COLUMBIA

The "butter" is prepared in two forms, soft, and in firm cakes. It is said to be excellent for cooking purposes. It retails at about fourteen cents a pound.

The soil and climate of Trinidad and Tobago are very favorable to cocoanut growing, especially along the coasts and in interior districts which come within the influence of the salty atmosphere. At present the export price of the nuts averages about $16 per thousand; of copra, four to five cents a pound, and of the oil, ninety cents a gallon. The largest producer grows 5,000,000 nuts a year. The shells are used as fertilizer and for road making.

In Brazil there are wild cocoanut groves over 200 miles long, and millions of the nuts are shipped annually from there to the United States and Europe. Cocoanut palms are largely used in Brazil to adorn the public parks and gardens. They often grow 80 to 90 feet high. The leaves are from 15 to 20 feet long, and at their base the nuts hang in clusters of three to fifteen each.

The foregoing instances are cited as a few out of the many reports which have been made recently to demonstrate the enormous proportions which this industry is reaching.

Concerning the origin of the cocoanut palm, many opinions have been expressed. Prof. O. F. Cook, in an excellent paper on the "History of the Cocoanut Palm in America," published in "Contributions from the National Herbarium," affirms that it was already widely distributed in the new world before the arrival of the Europeans, and he believes that biological evidence of the American origin of the palm is complete and adequate, while De Candolle and other writers believe that the cocoanut palm was introduced into South America and the West Indies by European settlers, and that it existed in pre-Spanish America only on the Pacific coast of the Panama region. This writer also affirms that it had its origin in the old world whence it was disseminated by sea. One thing is sure, however, that wherever it originally came from, it is now met with in all tropical regions.

Prof. Cook believes that hardy varieties of the palm might be successfully cultivated in southern California and Arizona, and perhaps in some parts of Texas, where flowing artesian wells of warm water may make it possible to protect small areas from frost—an important essential indeed. A cocoanut industry has already been established in southern Florida, and one planter is reported to have recently sold his crop for $15,000.

The cocoanut palm has pinnate leaves, and male and female flowers on the same tree, the female flowers at the base of each spadix. It grows to a height of 60 to 100 feet, and on the cylindrical stems appear rings marking the place of former leaves. At its summit is a crown of from 16 to 20 leaves. Of the three round, black scars at one end of the shell, the largest one, through which an opening is commonly made to get out the milk, is the destined outlet of the germinating embryo, which is situated there, the kernel consisting generally of the endosperm destined for its nourishment.

The oil of the cocoanut is obtained by pressure of the bruised kernel, or by boiling over a slow fire, and skimming off the oil as it floats to the surface. A quart may be obtained from seven or eight cocoanuts. It is liquid at the ordinary temperature of tropical countries, but in colder climates becomes a white, solid, butter-like oil. It becomes liquid about 74 deg. F. It can be separated by compression into a liquid portion called "olein," and a more solid art termed "stearin" or "cocosin," which is of complex constitution. The cake resulting from the pressure of the endosperm for its oil is an important cattle food.

The root of the cocoanut palm possesses narcotic properties, and is sometimes chewed instead of the areca nut. When the stem is young its central part is sweet and edible, but when old, it is a mass of hard fiber. The terminal bud (palm cabbage) is esteemed a delicacy, and trees are often cut down for the sake of it. The saccharine sap of the flower spathes, before they open, is a source of "toddy" and palm wine, and also, by distillation, of the liquor "arrack." In the East Indies the juice is often boiled down to yield sugar (jaggery).

The dried leaves of the cocoanut palm are much used for thatch, and for many other purposes, as the making of mats, screens, baskets, etc., by plaiting the leaflets.

The midribs of the leaves supply the natives of the tropical coasts with oars. The wood of the lower stem is very hard, takes a beautiful polish, and is employed for a great variety of purposes, under the name of "porcupine-wood." The fibrous center of old stems is made into cordage. By far the most important fibrous product of the cocoanut-tree is that obtained from the husk of the somewhat immature nut. If the nuts are allowed to ripen the "coir," which is a fiber beaten out from the external husk, is coarse and brittle. The husk of the ripe nut is used for fuel, and also, when cut across, for polishing furniture, scrubbing floors, etc. The shell of the cocoanut is made into cups, goblets, ladles, etc., and is often finely polished and elaborately ornamented by carving.

COCOANUT PALM AT BELSIZE, BRITISH HONDURAS, SHOWING THE WIDER FORM OF THE LEAVES UNDER SEA-LEVEL CONDITIONS

From the paragraphs given above it will be seen that every part of the cocoanut palm has a special value.

**Last year** there were in all parts of the world nearly 3,150,000 acres cultivated for the cocoanut palm. The number of palms was about 220,000,000, which bore not less than 7,000,000,000 of nuts, the majority of which were consumed for food purposes where they were produced.

Central and South America, with the West Indies, had 880,000 acres, the export trade therefrom, in all products of the cocoanut palm, exceeding $3,000,000 in value. Jamaica exports about 12,000,000 nuts a year; Trinidad, 9,000,000, while from the San Blas coast of Panama alone 6,000,000 nuts are shipped annually to the United States. These sell for $33 to $45 per 1,000 in the New York market, and are considered to be of the finest quality produced anywhere in the world.

Both coasts of Panama are already profiting by their proximity to the Panama Canal, according to Dr. Charles Melville Brown, who has recently made a special tour of inspection through Panama, and new plantations on a much larger scale are already being set out, in anticipation of the opening of the canal. Favored by abundant rainfall, equable climate, sea breezes from both oceans, with an artery of transportation to feed all parts of the world passing directly through it, and with its already established reputation for the quality of the cocoanut which that region produces, Panama presents, in Mr. Brown's opinion, a "fertile field for the development of the cocoanut industry within the next few years." Its west coast, he remarks, does not suffer from the hurricanes that sweep over the West Indies, its markets are up and down both coasts, and it is favored with abundant water transportation, which is an important factor in cocoanut cultivation.

COCOANUT PALMS AT SALAMA, GUATEMALA, AT AN ALTITUDE OF NEARLY 3,000 FEET

These facts might well be carefully digested by the vast army of young men seeking profitable employment.

In starting a cocoanut plantation the first step necessary, after acquiring a suitable tract of land, is the selection of proper seed nuts from which the young palms are to be grown. After they are six months old, clearing and transplanting takes place, though some planters prefer to transplant them to a second seed bed, setting them out about three feet apart, and leaving them in this second bed for 12 to 18 months longer. Ultimately the palms are set out at a distance of from 18 to 30 feet apart. Under very favorable conditions they begin to bear fruit between the fifth and sixth years after planting, and often continues to bear for 70 to 80 years. The production should gradualy increase to 250 nuts a year.

In the West Indies and Central America the cocoanut palm is liable to attacks of fungi, as well as to a disease caused by bacteria and known as "bud rot." This disease is generally caused by the deposition of some insect's eggs in a wound in the tender stalks of the undeveloped leaves. Dr. Edwin Smith, of the United States Department of Agriculture, has published an exhaustive report of the subject.

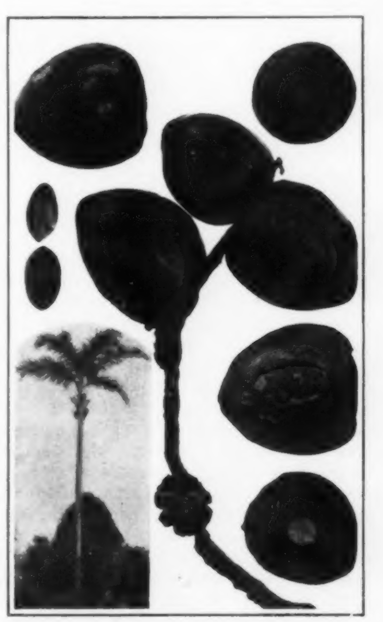
The first remedial act is to destroy all diseased palms, whether they are only just beginning to be attacked or are in a dying conditions. The roots should be dug out, and, with the stem leaves, burned up. Lime, preferably quicklime, should be well dug into the affected spot, and the ground frequently dug over, so as to break up and aerate the soil. If necessary, the soil should be drained, the weeds on the ground should be destroyed, and heavy manuring resorted to. No palms should be planted in the infected spot for a year after the removal of the diseased trees.

Horned beetles devour the leaves of the cocoanut palm in Samoa and other localities, and the best safeguard against the ravages of insects is to plant the trees directly along the seashore within the influence of the salt spray. The cocoanut palm is attracted by sunshine and will bend in any direction to reach it.

INFLORESCENCE OF THE COCOANUT PALM WITH STAMINATE AND PISTILLATE FLOWERS

Rats, too, and porcupines attack the nuts and stems of this palm, respectively, while wild pigs eat the tips of the young leaves.

The illustrations accompanying this article have been kindly lent to me for this occasion by the Bureau of Plant Industry, United States Department of Agriculture. They include not only cocoanut palms, but also their relative, the peach palm (*Guilielma speciosa*) of Costo Rica, with its fruit and seed. The peach palm bears a fruit almost as large as an apricot and of a reddish-yellow color. It forms an important article of diet among the natives of a vast region along the eastern slopes of the Andes, from Brazil and Peru through Ecuador, Venezuela and Colombia, and beyond the Isthmus of Panama in Costa Rica.



PEACH PALM, FRUIT AND SEED

## Heat from the Earth

CERTAIN scientific men now believe that the enormous internal heat of the earth may be utilized for some practical purpose. Among the most distinguished scientists that hold this view may be mentioned Prof. Hallock, of Columbia University, who is of the opinion that the plan is distinctly feasible.

It is not merely a question of getting steam; it is a question of the quantity of steam that can be had. Near Boise, Idaho, hot water is now drawn from a well and used to heat a dwelling. The Pittsburg and Wheeling wells are capable of heating the water left in them over night; but even if their depth were sufficient to turn the water to steam, it would require so many hours' waiting as to rob the process of all commercial value. In other words, there would not be the slightest difficulty in obtaining steam from the interior of the earth, because that involves only a little extra labor in boring into the hot area, and it is almost as easy to bore ten thousand feet as six thousand; but in order to give the steam commercial value, a method must be provided for dropping the water to the hot area, allowing it to heat, and yet having it returned to the surface as steam, without interrupting the flow.

Two holes might be bored into the earth, twelve thousand feet deep and perhaps fifty feet apart. There would be a temperature far above the boiling point of water. Then, if very heavy charges of dynamite or other explosive were lowered to the bottom of each hole and exploded simultaneously, a sufficient connection might be established between the two holes. The rock would be cracked and fissured in all directions, and shattering it thus around the base of the holes would turn the surrounding area into an immense water heater. The water poured into one hole would be heated and turned into steam, which would pass through the second hole to the earth's surface. The pressure of such a column of steam would be enormous; for, aside from its initial velocity, the descending column of cold water would exert a pressure of at least five thousand pounds to the square inch, which would drive everything movable through the second hole. The problem is, therefore, a mechanical one, concerned chiefly with connecting the two holes. This accomplished, the water heater would operate itself, and establish a source of power that would surpass anything now in use.

THE PEACH PALM (GUILIELMA SPECIOSA) IN COSTA RICA, A RELATIVE OF THE COCOANUT

## Disappearance of Lakes

WHETHER the globe on which we dwell is gradually drying up or not is a question that has been much debated. Recent discoveries in Central Asia have been regarded by some as favoring an affirmative answer, but others have replied that the observed phenomena are simply periodic changes. Dr. Walser of Zurich champions the affirmative view on the ground that a great number of European lakes have certainly disappeared within the last two hundred and fifty years. The canton of Zurich, for example, had one hundred and forty-nine lakes a quarter of a century ago, and only seventy-six to-day. He believes that a similar tendency to disappearance has affected the lakes of Germany and Russia.

**Wood-stain for Canes.**—(a) Prepare solutions of logwood decoction 1 part of logwood in 1 part of water; a solution of 0.12 part of caustic potash in 1 part of water. The object is first immersed in the hot logwood decoction, dried, and then painted with the dilute caustic potash solution. Finally place in chromate of potash (hot). (b) 250 parts of bleached shellac, 400 parts of benzole and 80 parts of Venice turpentine (prime quality) dissolved in 2,000 parts of rectified alcohol and the precipitate filtered out.

# Radiant Energy and Matter—III*

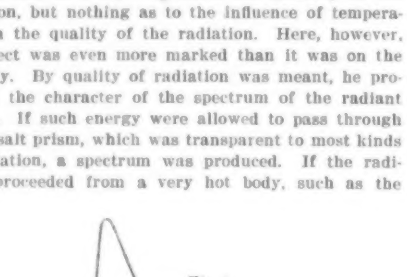
## Sir J. J. Thomson's Royal Institution Lectures

**Continued from Supplement No. 1850, page 371**

In opening his third lecture at the Royal Institution, Sir J. J. Thomson, F.R.S., said that on the last occasion he had explained that the radiometer effect constituted a very great difficulty in demonstrating the existence of a pressure due to light. When light fell on a delicate vane, the vane was warmed, and when its temperature thus became different from that of the walls enclosing it, effects were obtained, due to the communication of heat from the warmed vane to molecules of the gas inside the bulb. These in their turn gave up this heat to the walls of the enclosure, and, flying back, were reheated again at the vanes, and the result was that a torque was established between the system of vanes and the bulb containing them. On the last occasion he had described how Prof. Poynting had eliminated this effect by fixing the vanes rigidly to their mica enclosure, the whole system being suspended from a quartz fibre and deflected as a whole by the light pressure falling on one of the vanes. Sir James Dewar had arranged for him an experiment in which this radiometer effect was got rid of in another way. Evidently, since this effect arose from the presence of gas in the vessel, if this gas were entirely removed, the radiometer effect would disappear. To make the effect negligible it was, however, necessary to remove practically the whole of the residual gas, which was by no means an easy matter to accomplish. Sir James Dewar had, however, prepared for him a radiometer in which the vacuum was so good that the radiometer effect was absent. This was done by forming the radiometer bulb with a small narrow branch containing charcoal, and immersing this stem in liquid air.

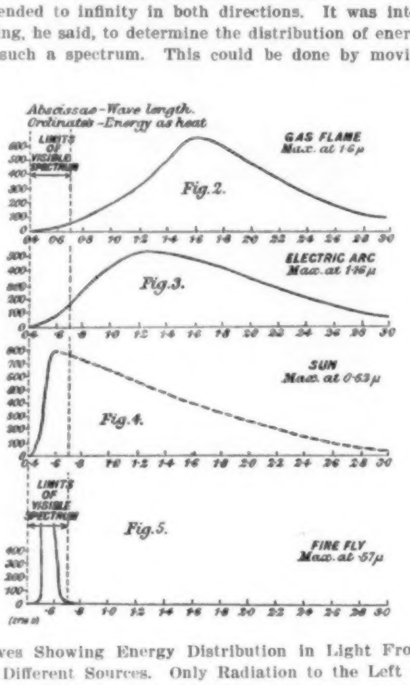
The lecturer then showed that, on exposing this radiometer and an ordinary one to the same source of light, the vanes in the former remained stationary, while the latter spun round rapidly. On next removing the vessel of liquid air from the stem already mentioned, and thus allowing the charcoal to warm up, the mercury vapor then liberated inside the bulb was sufficient to set the vanes in rotation, while on replacing the liquid air they again came to rest as the vacuum became perfected by the condensation of the mercury vapor in the pores of the cooled charcoal. A vapor pressure of less than $\frac{1}{1000000}$ of an atmosphere was, the lecturer said, sufficient to produce rotation of the vanes.

Taking account of the existence of this light pressure, it was possible, he continued, to prove, as he had shown last week, that the total amount of energy radiated from a black body must vary as $\theta^4$, where $\theta$ denoted the absolute temperature. This law, he proceeded, told us everything about the quantity of the radiation, but nothing as to the influence of temperature on the quality of the radiation. Here, however, the effect was even more marked than it was on the quantity. By quality of radiation was meant, he proceeded, the character of the spectrum of the radiant energy. If such energy were allowed to pass through a rock-salt prism, which was transparent to most kinds of radiation, a spectrum was produced. If the radiation proceeded from a very hot body, such as the




Curve Showing the Distribution of Energy in a Spectrum. Wave Lengths are Plotted as Abscissæ From Left to Right, Energy Vertically Upward as Ordinates. Note the Very Abrupt Falling off For the Short Wave Lengths

lime in the limelight, a certain amount of the spectrum would be visible to the eye, which could see a certain distance towards the red end of the spectrum, and also for a certain distance towards the violet. In the case taken, however, this visible portion was a very minute fraction of the whole radiation. In fact, the visible spectrum covered only about one octave, the longest wave-lengths visible being 0.75 $\mu$, and the shortest about 0.4 $\mu$, where $\mu$ represented $\frac{1}{1000}$ millimeter. On the other hand, Rubens and Woods had recently demonstrated the existence of waves having a length equal to 108 $\mu$—that was to say, comparable with $\frac{1}{10}$ millimetre—and there was no reason to believe that this was a limiting value. Probably, indeed, a hot body sent out radiations the wave-lengths of which extended to infinity in both directions. It was interesting, he said, to determine the distribution of energy in such a spectrum. This could be done by moving




Curves Showing Energy Distribution in Light From Different Sources. Only Radiation to the Left of the Dotted Line is "Visible." Note That *all* the Radiation From the Fire Fly is Visible, But Only a Very Small Proportion of the Light From All Other Sources

a very fine platinum wire from point to point of the spectrum, and then measuring electrically the temperature it acquired at each point. This procedure gave an indication of the energy distribution, and if the results were plotted against wave-lengths as abscissæ, a curve such as that indicated in Fig. 1 was obtained, in which the verticals were proportional to the energy of the radiation of corresponding wave-length. This reached a maximum at a particular value of the wave-length, and, as would be seen, the curve "tumbled down" from this maximum extremely rapidly on the side of the shorter wave-lengths. Curves, such as the foregoing, drawn for a number of radiating bodies, were all similar in character, but the position of the maximum ordinate moved very rapidly toward the side of shorter wave-length as the temperature rose. The wave-length of maximum energy, the speaker continued, was connected with the temperature of the radiating body by the following equation,

$$\lambda max. \theta = 2940,$$

where $\lambda max.$ denoted the wave-length in $\mu$, and $\theta$ the absolute temperature in Centigrade degrees.

Thus, for the sun, which had an absolute temperature of about 6,000 deg., the wave-length of maximum energy was about $\frac{1}{2}\mu$, which lay in the yellowish-green part of the spectrum. At 16 deg. C., or 289 deg. absolute, the equation gave $\lambda max. = 10\mu$ nearly, which was far beyond the visible portion of the spectrum, the limit of which on the red side was about 0.75 $\mu$, corresponding to a dull crimson. Hence, increasing the absolute temperature, from that of the lecture room to that of the sun, shifted the wave-length of maximum energy from 10 $\mu$ to $\frac{1}{2}\mu$.

The relative amount of energy in different parts of the spectrum, Sir Joseph continued, varied more rapidly with change of temperature than did the total energy. If the temperature of a body were raised from 300 deg. absolute to 600 deg. absolute (which was just below the limit of visibility), the total radiation would be multiplied by 16, but it by no means followed that the energy of each constituent of the spectrum was increased in the same ratio. In fact, by such a rise of temperature the energy in certain of the very short wave-lengths was multiplied by millions, and, in brief, the multiplier was extraordinarily different in different parts of the spectrum.

It was interesting, the speaker continued, to note the abrupt fashion in which the energy curve tumbled down on the side of the shorter wave-lengths, and to exhibit this more strikingly he had prepared the following table showing the proportion of the total energy which lay to the left of the spectrum, having 1.8 $\mu$ as the wave-length of maximum energy:

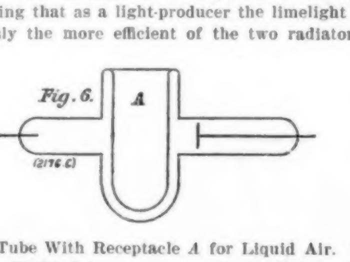
| Wave-Length $\lambda$. | Energy in Waves Shorter than $\lambda$. |
|---|---|
| $\lambda_{max.} = 1.8\mu$ | $\frac{1}{4}$ |
| $\frac{1}{4}\lambda_{max.}$ | $\frac{1}{100}$ |
| $\frac{1}{8}\lambda_{max.}$ | $\frac{1}{1000}$ |
| $\frac{1}{10}\lambda_{max.}$ | $\frac{4}{1\,000\,000}$ |

Referring again to Fig. 1, it would, the speaker continued, be seen that by far the larger proportion of the energy lay on the side of the larger wave-lengths. At higher temperatures, however, the proportion of energy in the visible spectrum and on the ultra-violet side increased, as was shown by the following figures:

| Absolute Temperature, deg. Cent. | Proportionate Energy Lying Beyond $\lambda = 0.7\mu$. | Proportionate Energy Lying Beyond $\lambda = 0.5\mu$. |
|---|---|---|
| 1500 | $\frac{1}{10\,000}$ | $\frac{1}{40\,000}$ |
| 2000 | $\frac{1}{100}$ | $\frac{1}{13\,000}$ |
| 2500 | $\frac{1}{27}$ | $\frac{1}{184}$ |
| 3000 | $\frac{1}{11}$ | $\frac{1}{61}$ |
| 4000 | $\frac{1}{3}$ | $\frac{1}{64}$ |

It followed, therefore, that, in using an incandescent lamp with a filament at 1,500 only about $\frac{1}{40000}$ part of the total energy supplied was utilized as light, the remainder being spent in heating up the bulb of the lamp. If the filament were raised to 2,000 deg. absolute, then the energy lying on the short-wave side of the extreme red was 1 in 100, and 1 part in 13,000 lay beyond the yellowish-green, to which the eye was most sensitive. With a temperature of 3,000 deg. absolute one part in eleven of the total energy lay in the visible spectrum, and when the temperature was 4,000 deg. absolute, nearly one-third of the energy lay to the left of the red extremity of the visible spectrum, and one-thirteenth in the portion most useful for vision. Thus, with low temperature sources of radiation only about $\frac{1}{40000}$ of the energy was usefully applied; with the carbon arc, on the other hand, having a temperature of about 4,000 deg., nearly one-third was utilized. It was on account of the higher temperature at which they could be run that metallic filament lamps were so much more efficient than the carbon filament lamps. With the latter having a temperature of about 2,000 deg. absolute, only about 1 per cent of the energy served to produce light.

To illustrate the small correlation between the total amount of energy radiated and amount utilizable for purposes of vision, the lecturer next placed a thermopile between a limelight and a red-hot ball, each source heating an opposite face of the instrument. He showed that in the conditions of the experiment the thermopile indicated that it received equal heat from the two sources when about midway between them. Substituting then a photometer for the thermopile, he showed that it was impossible under any condition to get a balance between the light from the ball and that from the limelight. No matter how close the photometer was moved to the ball, the side exposed to the limelight was always much the brightest, showing that as a light-producer the limelight was enormously the more efficient of the two radiators.




Vacuum Tube With Receptacle *A* for Liquid Air. The Light Emitted is in no way Diminished by This Intense Cooling.

The temperature at which radiation first affected the eye, was, he said, a matter of considerable interest. No matter how carefully one might prepare the eye by previous sojourn in a dark-room, it was impossible to perceive by it any radiation from a body at the temperature of boiling water. If the temperature were gradually raised, however, there came a stage, pretty much the same for all bodies, and within narrow limits for all individuals, at which light was perceived. All agreed that this first perception was not red, though the sensation was differently described by different people. His own view was that this first

* Report taken from *Engineering*.

perceivable radiation was not a color sensation at all in the sense in which we got colors at higher temperatures. If the experiment were tried, it would be noticed that the light was best seen when the source was looked at, not directly, but out of the corner of the eye. This circumstance, he thought, gave a clue to what the nature of the first impression really was. In the retina there were two sets of structures—viz., rods and cones—the latter being concerned in the sensation of color. The rods apparently were affected by radiation slightly before the cones. Hence the first effect of radiation, as the temperature rose, was on the rods only, the impulse being insufficient to affect the cones. This explained why this first perception of light was best seen out of the corner of the eye. In normal conditions the eye naturally focussed for the "yellow spot," which was the part most sensitive to color, and consisted almost wholly of cones. Thus if the rods were first affected, the eye ought to perceive the radiation with the rods, and not with the cones, and the image should therefore be formed on the retina at a point where the rods were more plentiful, and not on the yellow spot. Evidently it would follow that animals which "saw in the dark" should cultivate rods rather than cones, and his zoologist friends informed him that the eye of the owl was remarkable for the extremely great proportion of rods as compared with cones. Probably the owl might not in a faint light see any distinct color, but it saw something good enough for its own purposes where ordinary mortals would see nothing.

The sensitiveness of the eye to different colors, the lecturer proceeded, varied in a most extraordinary way. Langley had made an estimate of the energy required to excite various color sensations. Taking as unity the energy required to excite the sensation of a dull crimson red, then $\frac{1}{100000}$ of this amount would suffice for the yellowish-green. It was remarkable that the sensitiveness of the eye to light was greatest for the wave-length of maximum energy in the solar spectrum. It would, he said, be interesting, were it possible, to investigate whether the eyes of such animals as had remained unaltered for long geological periods had a maximum of sensitiveness to the light of the same color as we had. If the sun's temperature had changed within the geological period covered by the life-history of such organisms, it was possible that the latter would prove to have a maximum of sensitiveness for some color other than the yellowish-green. From the table already given above it would, he continued, be seen that the energy radiated from most incandescent bodies lay nearly all in the non-luminous portion of the spectrum. In the case of the arc light nine-tenths of the energy supplied and paid for was wasted. The ideal to aim at in illumination was the production of radiation confined to the color to which the eye was most sensitive. Engineers had not yet succeeded in doing this, but there were certain lowly animals which had solved the problem for themselves, the firefly, for example, producing light most efficiently.

The spectrum of the firefly had first been investigated by Langley, whose results were very remarkable. He had given the diagrams, Figs 2 to 5, showing the amounts of total and of useful energy radiated from different sources. Of these, Fig. 2 represented the energy distribution in the spectrum from a gas flame, the useful portion of the energy lying to the left of the dotted vertical. In the case of the firefly it would be seen that every bit of the energy radiated lay in the proper place, nothing being wasted either in the production of heat or of ultraviolet rays. It seemed, therefore, that the future of lighting might lie in the finding of some substance capable, when suitably excited, of producing light like the glow-worms, without the expenditure of energy in long waves.

That heat was not a necessary concomitant of light could, he continued, be shown by the following experiment. The apparatus (Fig. 6) used was a vacuum tube having a receptacle for liquid air formed in it at *A*. On exciting this tube, Prof. Thomson showed that filling the cup *A* with liquid air in no way affected the production of the light. There was no dark space formed near the walls of the cup, though the temperature there must have been very little above that of the liquid air.

The sensitiveness of the eye to small amounts of energy was, the lecturer continued, exceedingly remarkable. In the greenish yellow the expenditure of $\frac{1}{100000000}$ of an erg could be distinguished by the eye. If vision were due, in the first place, to chemical changes produced by the light, it could be shown, if these changes were of the same order as those to which we were accustomed in the laboratory, that the amount of matter decomposed by this amount of energy could not exceed a few thousand individual molecules. The eye must, therefore, be extraordinarily efficient in detecting chemical changes, if this were actually what it did do in the act of seeing. On the other hand, others held that chemical actions were not involved, but that in the eye there were systems capable of taking up any kind of vibration, and being set into resonance by it. If the action were primarily chemical, the fact that the changes were produced only by light of short wave-length constituted a difficulty. There was, however, one view of light on which this difficulty would not arise, and this was coming into favor with many physicists, who held that radiation was built up of a number of different units of energy somewhat resembling the particles in the old corpuscular theory. The energy of the light was concentrated into these individual units, the amount in each unit being more the shorter the wave-length of the light. If this were so, it would be easy to understand how it was that chemical action was excited by light of short wave-length only. If the change in question required more energy than an individual unit contained, it would not be effected, and as the units corresponding to the shorter wave-lengths contained the most energy, it was with these that chemical activity should be associated.

(To be continued.)

# A New System of Perforating Metal

## Andrew Smith's Improvement

A FEW years ago Andrew Smith, a mechanical engineer of San Mateo, California, had under his supervision the construction of a number of water wells. It was found by him in common with all engineers that the difficulty of using the ordinary well casing was almost insurmountable. A number of attempts to improve the methods of making perforated casing were made by him, the object being directed to get a definite water area through the use of inner and outer slotted tubes. These attempts were governed to the well-established rule that sheet metal cannot be punched with a punch narrower than the thickness of the metal. These tubes were so placed as to provide openings sufficiently small to prevent the ingress of fine sand and silt. While this was a distinct advance in the art of constructing water well casings, the results were not fully satisfactory to the experimenter, for he felt that the same result should be obtained with a single tube casing.

Further experimentation proved that an entirely new process of perforating metal had been developed, and that by this process sheet steel one-half an inch thick could be perforated with slots one-thousandth of an inch wide by any desired length, or that a slot of any desired width could be made. While developing the new process of perforating metal, most of the leading metal-perforating establishments in the United States were consulted. Some went so far as to say that the feat was impossible, others that it was impracticable, while still others stated that the inquirer was wasting time in trying to solve the problem.

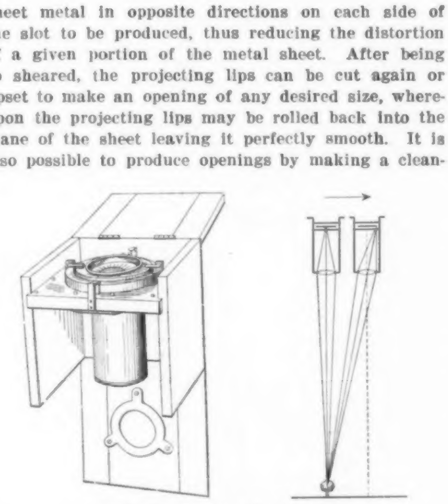
The invention, in common with many other important discoveries, is very simple when it is known how it is done. The old way of cracking the metal with a sharp chisel to make slots narrower than the thickness of the metal, left rough, jagged openings and bulged the metal outwardly. This outwardly bulged metal was exposed to corrosions and made the casings difficult to drive because of the great resistance of the projections. The first attempt made by Mr. Smith to obtain a casing with slots of the required width resulted in a clean-cut shear by depressing one edge of the metal a little more than its thickness thereof, thus producing a smooth opening not at all like the old cracked perforation. This style of perforated metal can be used, for example, in shallow water wells, drain tiling, or irrigating pipes.

The step having been taken and the sheet actually sheared to produce the given slots, the next step was to make a clean-cut shear by depressing the sheet metal in opposite directions on each side of the slot to be produced, thus reducing the distortion of a given portion of the metal sheet. After being so sheared, the projecting lips can be cut again or upset to make an opening of any desired size, whereupon the projecting lips may be rolled back into the plane of the sheet leaving it perfectly smooth. It is also possible to produce openings by making a clean-cut shear first and then rolling the projecting portions back into the plane of the sheet, the uncut portions between series of slots being rolled enough to stretch the metal to make the openings. This latter process is the most ingenious part of the new invention for the reason that the perforating can be done by having suitable dies in rolls or in a gang punching machine. As soon as the plate has been passed through the rolls or gang punch, the sheet may be passed through another set of rolls, which rolls the lips back into place and stretches the metal the proper amount.

This process does away with the use of fine saws, fine milling, or fine punches such as were required by the old processes, and results in saving considerable money for tools alone, since each tool used is very strong and withstands an enormous amount of wear.

Two of the most important uses for this perforated metal lie in the water and oil well casing fields. The first requires a very fine casing to prevent sand from passing into the well, and the latter requires a very strong and heavy casing to prevent injury thereto, each of which conditions may be adequately met by this process.

Another form of the casing is produced by depressing the casing with a sufficiently large punch to form a clean-cut shear, after which one edge of the depressed lip is cut at an angle to the first cut, so that when the metal is returned to the general plane of the plate, a V-shaped slot is formed. The advantage of such fine V-shaped perforations cannot be over-estimated. Where the oil or water sands are struck, the gas, oil or water enters the perforations at once, and therefore equalizes the pressure and prevents the sands from heaving up in the casing. When the casing has been put down the required depth, the well casing itself acts as a strainer, and it retains at the narrowest portion of the V-shaped slots all fine material, any material passing into the casing not being retained by said slots since the narrowest portion is at the outer circumference thereof. Such a casing has more than ten times the capacity of the old cracked casing, and it is much stronger for the reason that the metal is not broken transversely to the slots formed.



A COMPASS FOR BALLOONS.

### A Compass for Balloons

DR. BESTELMEYER has invented a compass by which the direction and velocity of a balloon's flight can be determined in a very convenient and practical manner. A transparent compass card, with its needle, is attached between two glass plates to the top of a wide aluminium tube which is swung on gimbals in the usual manner. The lower end of the tube carries a lens by which an inverted image of the landscape is thrown on the compass card. When the balloon is moving in any given horizontal direction the image of every point of the landscape moves across the compass card in the same direction, as is shown in the diagram. The pilot selects a point of the landscape which passes exactly under the center of the card, and notes the point of the compass at which it leaves the circumference. This observation gives the direction of the balloon's course. The horizontal velocity of the balloon is determined by measuring, with a stop-watch, the time occupied by a point of the landscape in moving from the center of the compass card to the circumference of a circle of one centimeter radius, which is inscribed on the card. From this interval, in combination with the height of the balloon, obtained by other observations, the velocity of the balloon is obtained by reference to a table.

**Alloy for Stuffing Boxes** (also for faucet plugs).—Copper 86.2 parts, tin 10.2 parts, zinc 3.6 parts.

# Romanized Typewriter Type

**By Jacob Backes**

It is part of every business education imparted with thoroughness on modern lines to learn how to produce, or at any rate how are produced through the agency of several imitative processes, "facsimile" and "form" letters which, when filled in with names and addresses on a real typewriting machine with matching ribbon and skillful manipulation, may serve the purpose of giving to each of the unsuspecting recipients of the letters the idea that the communication was directed to him only.

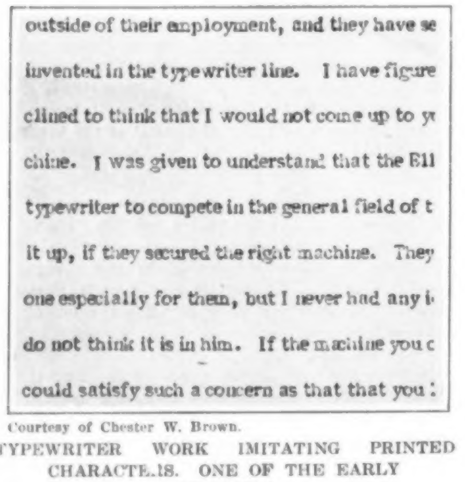
On the other hand, the ability to quickly discern the really and individually typewritten letter in the morning mail is also a very useful part of that same kind of modern education.

A well-executed "form" letter is, in a way, a flower of applied knowledge. The grammar, spelling, diction, and general politesse of the average "form" letters are distinctly better than those of the average individually written letter. No form letter coming to the notice of the writer ever contained offense, in the lines or "between" them.

The increase in the "fac-simile" expert's ability to create simulative "favors," and the antagonistic development, in the mail clerk, of those apprehending faculties by the exercise of which such productions may be immediately recognized, are comparable to the increasing size and projective force of modern missiles of destruction, which step by step bear a certain and unmistakable relation to the improvement in the processes or appliances by which immunizers are created, or defensive armor is thickened and toughened.

Recent developments in typewriter technique and performance threaten still further complications. The army which makes use of the machine has literally become millioned, and astute manufacturers have found that among this array of users are many typists unable to summon enthusiasm for the conventional pattern and apparence of typewriter characters. These particularists, existing and vociferous from the very advent of the machine, have become numerous enough to be regarded by powerful typewriter organizations as worthy of special catering. Result: an output and increasing sale of machines equipped with types—variantly trade-known as "Imperial," "Clarendon," "Printype"—so fairly simulating customary printers' typographical outlines and shadings, that recipients oftentimes—so experience has proved—have, without perusal, thrown away letters typed with such characters, under the impression that they were common printed circulars.

It certainly is food for thought: that the better the wording, arrangement and layout of a letter is, and the more correctly and smoothly it is typed, the more likely is it to look like a "form" letter and to


outside of their employment, and they have se
invented in the typewriter line. I have figure
clined to think that I would not come up to y
chine. I was given to understand that the Ell
typewriter to compete in the general field of t
it up, if they secured the right machine. They
one especially for them, but I never had any i
do not think it is in him. If the machine you c
could satisfy such a concern as that that you :

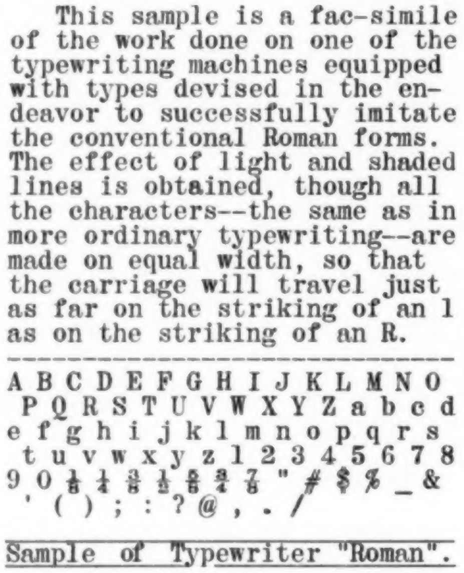
Courtesy of Chester W. Brown.

TYPEWRITER WORK IMITATING PRINTED CHARACTE..IS. ONE OF THE EARLY ATTEMPTS

be mistaken for one, especially when it is sent to or received from a stranger. This truth has so wrought on some who have felt aggrieved at finding themselves "taken in" by "imitators," that it has been suggested each writer of genuine letters should send an affidavit of genuineness to accompany his communication, or that some other device be introduced whose attachment to or appearance in a letter would purport a guarantee of freedom from the taint of "form" or "facsim."

The linotype machines, which set the type for most of the great publications of civilization, can be provided with matrices and adjustments by which lines with all the well-known characteristics of typewriting may be cast at will.

For several years type founders have been making type in 6, 8, 10, and 12-point sizes, well imitating, both in actual size and miniature, the genuine machined production, and selling this type to printers with edifying instructions as to how the imitative intent may be carried to successful achievement. Here are il-


This sample is a fac-simile of the work done on one of the typewriting machines equipped with types devised in the endeavor to successfully imitate the conventional Roman forms. The effect of light and shaded lines is obtained, though all the characters--the same as in more ordinary typewriting--are made on equal width, so that the carriage will travel just as far on the striking of an l as on the striking of an R.

A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z a b c d
e f g h i j k l m n o p q r s
t u v w x y z 1 2 3 4 5 6 7 8
9 0 ⅛ ¼ ⅜ ½ ⅝ ¾ ⅞ " # $ % _ &
' ( ) ; : ? @ , . /

Sample of Typewriter "Roman".

SAMPLE SHOWING HOW THE TYPEWRITER CAN IMITATE PRINTED CHARACTERS. THE LATEST ADVANCE

luminative citations from a circular:

"Messrs. Ambitious Printers:

"The work of typewriters using large type is closely imitated by using our 12-point new model ———— ———— No. 3. There are hundreds of job presses running constantly on this typewriter work in the large cities. The rapid increase in the mail order business and use of follow-up systems has created an enormous demand for this work, and no hustling printer can afford to overlook this source of profit.

"This is our new model ———— ———— No. 3 printed through silk. All our typewriter faces are made from dies furnished by the makers of the typewriter and duplicate the typewritten work. If you wish to match the work of any typewriter not mentioned here, send us a sample and we can undoubtedly furnish the type you want.

"If the addresses are to be filled in on a typewriter, have the strenographer write a sample letter. Use this as a color sheet and have the pressman work to it. You can vary the depth of color on the press, and not on the typewriter. Hence the pressman must work to the typewritten sheet. When addresses are not inserted, this typewritten color sheet is not necessary," etc.

A few specimens are herewith shown of what has been and is being accomplished by peculiar typewriting contrivances. It is seen that so well do printers imitate typewriting, and so well can typewriting be done to imitate printing, that any distinction which may have formerly existed between printers' characters and epistolary type has been submerged in the rising tide of imitation.

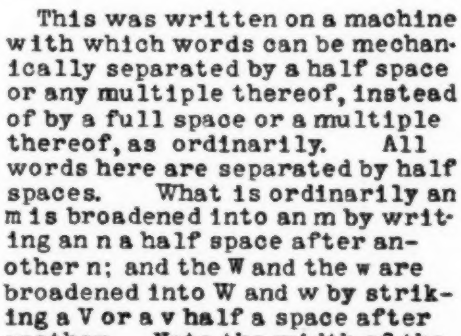
Incorrect notions are abroad of the versatility with which the genius of the manufacturer has endowed and will further continue to endow typewriter mechanisms. In times past, with the scarcer population and relatively little appreciation or understanding of mechanographical latencies, it was enough to make machines of limited range of performance and severe typographical restrictions. At present there is a universal market for them and a legion of critical yet appreciative users, which legion is divided, and subdivided, and yet again into sections requiring special things to be done, and in a special way; and to these purchasing divisions, each larger than the integer of not many years ago, the keen-sighted inventor finds it profitable to turn observant eyes.

## Elephant Domestication in Africa

While elephants are trained and commonly used for various purposes in Asia, it appears that in Africa there is as yet but little attention paid to this question. Some points about elephants in Africa and the great need of employing them so as to obtain a valuable aid have been brought out by Capt. Devedeix, a French cavalry officer, commanding the native troops of the Chari Tchad region. With forty-two of the cavalry he made a brilliant raid in the Ouadai region not long since, and is well able to speak about the present subject. How to supply the French troops of the Lake Tchad and Ouadai regions is becoming a very important question, and he proposes to use the African elephants for this purpose so as to replace the native carriers. Such work is very trying for the natives and often shortens their life, so that humane reasons are one of the points in favor of this.

Besides this reason there are somewhat numerous advantages to be gained by training elephants for domestic work. It is estimated that at present the number of elephants in Africa is 300,000 or 400,000, but it must not be forgotten that we are exterminating 50,000 every year, so that before many years the elephant will become extinct, like the American bison, for in the case of the elephant, its reproduction is far from keeping pace with the great slaughter of these animals which is now going on. It is likely that different regulations will be made in the future to try to stop this rapid killing off of the African elephant, and in fact some such decrees have already been issued in this country, showing that attention is being awakened to conditions. Special societies are even formed for preserving the elephant. Capt. Devedeix thinks that the example of Asia should be followed, and there is no reason why the elephants should not be trained so as to give a very good means of transport, especially as this is very much needed in the Congo region, which is the part of Africa under consideration at present. In this country the imported pack animals die off rapidly from marsh fever or lack of proper care. But the elephant is well adapted to replace pack horses or mules, by reason of its being accustomed to the climate, and besides its very long life of over a hundred years. Its force is ten times as great as the strongest of the other animals, and the remarkable intelligence of the elephant is proverbial. Not only can it be used for carrying loads, but at the same time it opens up routes through the dense forests.

In the Belgian part of Congo, steps have been already made toward training elephants, and the first work of the kind is carried out at the recently opened elephant farm at Appi, where there are fifty or more elephants now, and many more are to be added before long. The idea is due to a French officer in the first place, but it was the Belgian government which took the first steps to laying out an elephant farm on a large scale in the Congo, under Com. Laplume. At present the fifty elephants are well domesticated and are used for cultivating the


This was written on a machine with which words can be mechanically separated by a half space or any multiple thereof, instead of by a full space or a multiple thereof, as ordinarily. All words here are separated by half spaces. What is ordinarily an m is broadened into an m by writing an n a half space after another n; and the W and the w are broadened into W and w by striking a V or a v half a space after another. Note the width of the m and the w throughout this paragraph, and the unusually short distance between the words.

Courtesy of A. A. Clarke.

A "PRINTED" APPEARANCE IS PRODUCED BY USING A SPECIAL NARROW SPACING BETWEEN WORDS

soil, drawing wagons or carrying loads. Not long ago the first long trip across the country was made by one of the teams belonging to the farm, composed of eight animals, and they covered more than 400 miles, returning home in very good condition. In order to proceed with training a greater number of animals, it was decided to send experts to India and Ceylon so as to observe the methods of capture and domestication which are used there. After this it is intended to begin, not only with young elephants, but also with adults as well. The elephant is still abundant in the Congo region and in the neighborhood of Lake Tchad, and owing to the increasing needs of transportation it is desirable that some move be made toward establishing elephant farms in many places and on a large scale, as there is no good reason

why the African region should be deprived of the valuable services rendered by these animals, such as is seen so strikingly in India.

This condition of things is especially true in the regions where there are no railroads and such could only be built at an enormous cost, and even pack animals are lacking. Native porters are all that is to be seen in such regions for carrying loads and supplying the troops. Besides, should elephants be used, the natives would be free to take up agriculture, for which there is need of labor at present. Again, the natives themselves would soon be led to domesticate the animals, stimulated by the high prices which would be offered. For instance, an elephant when killed does not bring more than $60 or $80, while as in India the value of a trained animal is no less than $800 to $1,000. After this it remains to domesticate other African animals, especially the zebu and also the hippopotamus, which is now employed on rice plantations in other countries, as well as the ostrich and the antelope.

# The Morane Monoplane

## Scale Drawings of the Machine that Won the Paris-Madrid Race

**By John Jay Ide**

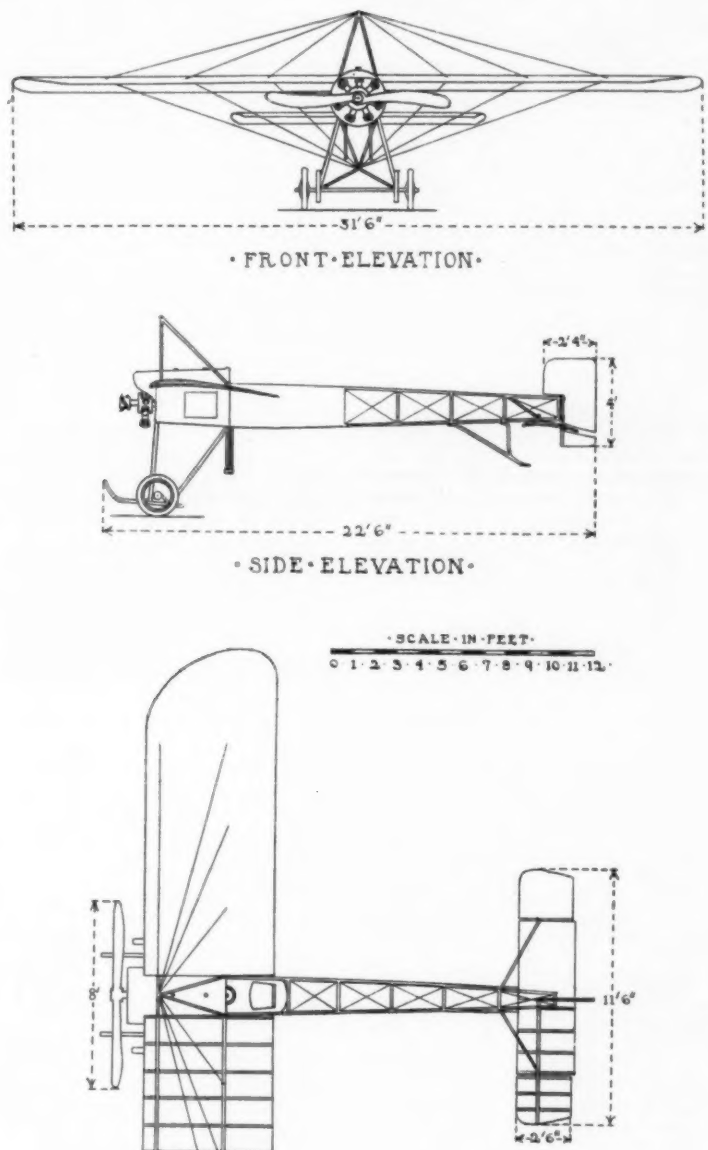
ONE of the most successful aeroplanes which have made their appearance recently is the Morane monoplane. This machine was designed by Leon Morane, in collaboration with Ralph Saulnier, formerly associated with Louis Blériot. Morane first appeared

VEDRINES. THE WINNER OF THE PARIS-MADRID RACE AT 60 MILES AN HOUR

in the public eye last summer at Reims, where he broke the world's records for five, ten, and twenty kilometers with the 100 horse-power Blériot XI. bis *type de course*. He also drove one of the Blériot XI. 2bis two-seaters which made their debut a few weeks previously. He used this same machine at Bournemouth, and it was with a similar model equipped with a 100 horse-power motor that he and his brother made their disastrous attempt last October to win the Paris-Puy de Dôme prize. Thus ended Morane's experience with the Blériot machine.

While prevented from flying as a result of his accident, Morane, with the aid of M. Saulnier, designed a monoplane which, although broadly resembling the Blériot, has several original features. One of the essential points of difference between the two machines is the landing chassis. In the Morane the chassis consists of two very short skids curved up in front so as to protect the tractor screw, and joined solidly to the fuselage by four main struts. By means of rubber rings the skids are joined to the axle, which carries the two wheels placed five feet three inches apart. The total weight of the undercarriage is only forty-two pounds and yet its strength may be realized by the fact that it has repeatedly withstood the shock of landing on bad ground at speeds of over eighty miles an hour with the wind.

VEDRINES IN FLIGHT




SCALE DRAWINGS OF THE MORANE MONOPLANE

A further difference between the Blériot and the Morane is in the entire suppression of the dihedral angle between the wings of the latter. This has been done with a view to obtaining increased speed. For the same purpose the wings have been made very flat on the underside and the point of maximum camber is very near the leading edge. It will also be noticed that the shape of the extremities of the wings has been radically altered. The mast carrying the upper wing stays is pyramidal and so arranged that the support at the front is more at right angles to the wings and so better protects the spars from overstress. The rudder is divided into two sections by the stabilizing tail, just forward of which is the light double skid.

With a view to reducing wind resistance, part of the fuselage, which is quadrangular in section, has been covered in with fabric. The pilot sits behind a long bonnet inclosing the tanks and extending over the engine. By this means he is protected from the spray of oil incidental to the employment of a revolving motor, which, in this case, is a 50 horse-power Gnome driving a Chauvière Intégrale tractor screw eight feet in diameter and five feet eleven inches in pitch. At 1,100 revolutions per minute, this

combination has driven the machine at a speed of seventy miles an hour officially timed on a closed circuit.

The leading dimensions are as follows: Span 31 feet 6 inches, length 22 feet 6 inches. The total carrying surface is 188 square feet, of which 151 are accounted for by the wings, the remaining 37 being in the stabilizing tail. The machine weighs 440 pounds empty, which shows with what great care the question of lightness has been studied; moreover, this result has not been reached at the expense of strength, and from the point of view of solidity the Morane monoplane can compare with any.

When the Morane was first brought out, Aubrun was taken over from Blériot and became the chief pilot. When he left to join the Deperdussin firm, Pierre Védrines was selected to fill the position. Védrines had been chief mechanic to Mr. Robert Loraine, the actor-aviator, and later had distinguished himself by some fine cross country flights on a Goupy biplane. On becoming chief pilot of the Morane, Védrines promptly did some more cross-country work, flying from Pau to Toulouse, Carcassone, and other places in the south of France, where hitherto little or no flying had been seen. Late in March he set out to fly from Paris to Pau but got lost in a fog. On the 30th of the month he did the famous Poitiers-Paris trip of 210 miles in two hours and twelve minutes at a speed of over ninety miles per hour with a twenty-mile wind. It was this feat which first brought the Morane to the attention of the American public. On April 22nd Védrines made another attempt on the Paris-Pau prize, and this time he succeeded in winning it. He covered the course of 500 miles in three stages. His actual flying time was six hours and fifty-five minutes, which gives a speed of 72.28 miles an hour.

The above flights were, however, completely overshadowed by the wonderful performance of the Morane in the Paris-Madrid race which started on May 21st under such tragic circumstances. Védrines, he wore a heavy helmet saved him from a gruesome, instantaneous death, and the fact that he landed on soft, marshy ground. His arms and left leg were broken and his face badly cut.

A number of searching parties set out to find him, including the Passionist monks from the monastery on Monte Fogliana, who know every foot of the mountainous country. Also a number of reporters at the Camorra trial, formed a party in search for him. He was found by the Red Cross searchers in an unconscious condition under the debris of his machine.

FRONT VIEW OF MORANE MONOPLANE FITTED WITH A GNOME MOTOR

who left Paris the day after the start, won the first stage; Paris-Angoulême, the second stage; Angoulême-San Sebastian, and was the only entrant to reach Madrid, thus winning the prize of $20,000 offered by Le Petit Parisien.

In the Paris-Rome-Turin race three Morane monoplanes were entered. Two of them, one driven by Védrines and the other by Gaget, quit the race. Andre Frey, however, continued. He started from the aerodrome at Buc on May 28th, and arrived at Dijon (162 miles), the reporting station, at 7:11 o'clock in the evening. He resumed his course at 4:16 A. M. toward Lyons, arriving there at 7:43 A. M., covering the distance of 108½ miles in 3 hours 27 minutes. At 8:45 he started again for Avignon (127 miles south), which place he reached at 12:05 o'clock P. M. on the 29th. He left Avignon at 5:35 A. M., arriving at Genoa shortly after 6 o'clock on the 30th—requiring 12 hours, 45 minutes time.

On May 31st Frey left Genoa with high hopes of overtaking the leaders. But in this he was not successful. At Pisa he mistook a racecourse decorated with flags for the San Rossare aerodrome, and he landed so heavily that the machine turned complete somersaults, and was so badly damaged that Frey had to send for a new one from Paris. Frey arrived in Rome on June 5th.

On Tuesday, June 13th, the German aviator set out to complete the last leg of the journey. He was warned against the attempt, but paid no heed to warning, and started out, in spite of the fact that other competitors who had intended to start also withdrew on account of a threatening sky. When but a short distance from Rome he encountered heavy fog that confused him, and soon lost his way, sailing into a terrific storm of rain, wind and hail. He endeavored to ascend above the clouds, but his machine refused to rise, and suddenly and unexpectedly it swooped downward, all control of it being lost by Frey. He was in the mountainous country between Viterbo and Rome, when his aeroplane fell into a ravine, burying him under the debris. The fact that

## Cold Storage

By H. E. Barnard.

The preservation of food stuffs so that the surplus created during seasons of plenty could be distributed throughout the year and the fresh products of one country shipped to another was at one time impossible. The use of chemical preservatives which arrested decomposition served, in a measure, to supply the need, but this doubtful method of retarding the natural spoilage of foodstuffs has given way almost entirely with the development of methods of refrigeration which make it possible for foods of every character to be placed in cold storage and there held for considerable periods without apparent change in composition or structure. Cold storage is simply the placing of foodstuffs in rooms kept at a sufficiently low temperature to hold the goods in normal condition until such time as these are needed for consumption. This temperature varies from a point several degrees above freezing to zero and below. Certain goods, such as fruits which can not well be frozen, can be kept without any spoilage for months at a temperature of about 34 deg. F., while butter and meats are stored at a temperature ranging from below zero to freezing. Poultry is usually stored at a temperature varying from 0—25 degrees. Cheese, supposed by manufacturers to cure or ripen in storage, is usually held at a temperature slightly above freezing. Cold storage at suitable temperatures undoubtedly improves certain foodstuffs up to a certain point. This is especially true in the case of fresh meats, poultry and fruits. Other products do not improve in storage and after a time begin to deteriorate even when kept at temperatures which inhibit to a large extent the ordinary processes of fermentation and decay.

The investigations of the United States Department of Agriculture on the effect of cold storage on eggs, poultry and game have been carefully worked out and have developed much data which throw a new light upon the results of storage at low temperatures. In general the results of the studies show that cold storage when properly used is a very valuable improvement in the methods of the conservation and distribution of the food supply and that the term "cold storage" as applied to foods is in no sense a mark of inferiority or low grade.

It is true that time limits are well established beyond which goods should not be kept in storage, and that if such foods as eggs, fish or poultry are held for a longer period deterioration, at first slight and later marked, takes place. But such time limits are sufficiently long to carry the products until the natural season of scarcity is past, and in fact carrying charges, insurance and interest on the money invested does not, except under most unusual conditions, make it profitable for the warehouse men to hold goods longer.

Food prices have been advancing rapidly and in part at least this has been attributed to the increasing practice of holding foodstuffs in storage and because of this fact, as well as because of the impression that they are of poor quality, cold-storage foods are viewed with disfavor by the consumer. This feeling, coupled with the constantly increasing tendency to throw additional safeguards around the food supply, has prompted the introduction of cold-storage bills in many of the State legislatures. In one State at least, namely Indiana, such a bill has been enacted into law. The bills up for consideration in the various States vary widely in character and on the whole show a great lack of information as to the purpose and practices of cold storage. In some measures the time limit placed upon the storage of foodstuffs is so short that the passage of such a law would demoralize the produce business and instead of reducing prices on food stuffs would bing a return of former conditions of plenty during the season and scarcity throughout the rest of the year.

The Indiana statute is entitled "An Act for the protection of the public health and the prevention of fraud and deception by regulating cold storage and refrigerating warehouses, the holding of food products stored therein and the sale of such products." It requires that foodstuffs which are entered into cold storage shall be marked with the date of entry and that when withdrawn for sale they shall show the date of removal. All foods products placed in cold storage shall be withdrawn at the end of nine months. It is provided, however, that such goods shall be subject to inspection as to their sanitary condition and that if the goods are found unfit for food they shall be destroyed. The authorities are furthermore instructed to condemn and close any warehouse which is not kept in a sanitary conditions. This measure does not discriminate against cold-storage goods in favor of goods which have been so kept, but it does provide that the purchaser of eggs, poultry or meat may know how long the goods have been in storage. Another section providing that the warehouse records shall be subject to inspection, and so making it possible to determine the amount of goods held in storage, will have a tendency to regulate the too frequent practice of speculation in the food supply.

During the past year foodstuffs, notably eggs and meat, have commanded very high prices although there was in cold storage an adequate supply of both products. The fact that the owners of much of these goods were obliged to sell at a loss and in many instances were driven into bankruptcy at the close of the season, does in no way compensate the consumer, who during most of the months of the year paid high prices for foodstuffs although following the break in prices, they for a short time were sold below their actual value.

Cold storage is necessary to the conservation of food products. It is to be hoped that the public will learn to appreciate more than now its value. It should be regulated by practical laws which do not have for their purpose the destruction of the business, but which are intended rather to put a stop to the practice of storing foods which are not suitable for refrigeration but which have, even before entry into storage, deteriorated or become unfit for food, and to assure the withdrawal of all goods before they have been held sufficiently long to undergo partial spoilage. Such legislation will also be of decided benefit to the cold-storage industry as all products will be subject to inspection and to this extent at least the quality of cold-storage foods will be guaranteed to the consumer.

## Snow's Radioactivity

Some interesting data have been gathered in France as a result of the study of the radioactivity of snow that fell at Boulogne during the past winter.

It has been known for some time that newly fallen snow is radioactive, but until the French scientists looked into the matter the subject was not examined closely.

The investigators announce that snow quickly gathered after its descent to the earth is highly radioactive. Radioactivity disappears almost entirely after the lapse of two hours, however. Snow which has fallen on the soil appears to retain its radioactivity a little longer than that which has come to rest upon the roofs of buildings.

**French Lithographic Pencils.**—Take of talcum 100 parts, soap 83 parts, shellac 70 parts, mastic 10 parts, lamp black 10 parts. The making up of this mass is effected in the same manner as described for the English pencils.

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JANUARY—JUNE, 1911.

The * Indicates that the Article is Illustrated with Engravings.